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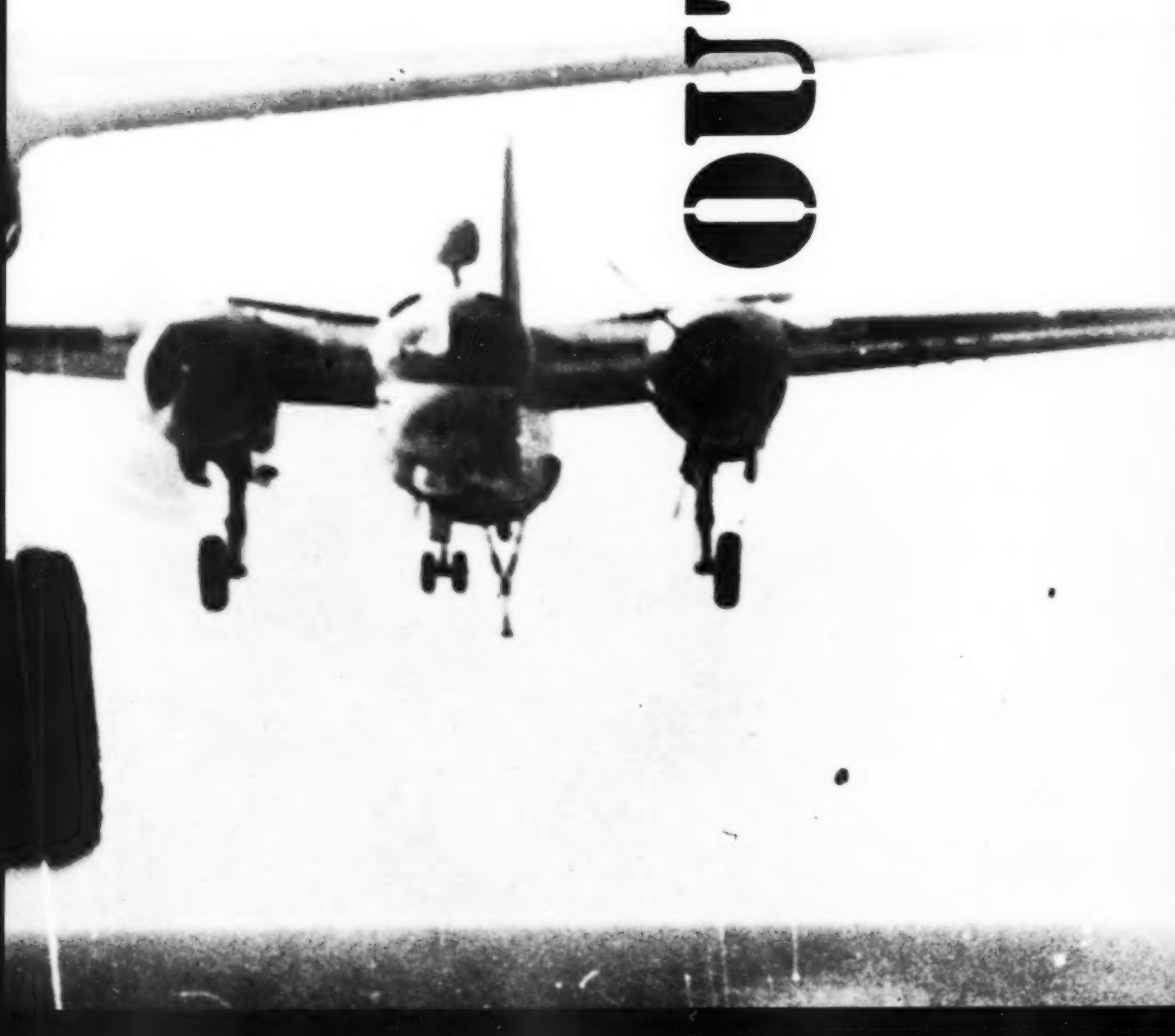
ENGINE OUT

By Jack LeBarron



Single-Engine Versus Twin-Engine . . . What Can Happen With A 50 Percent Power Loss

A pilot's attitude toward a twin-engine airplane is contradictory. Even though each wing displays a power plant, its reputation inevitably revolves around what sort of single-engine aircraft it makes. An otherwise friendly machine can become a roaring dragon when deprived of 50 percent of its power.

Such a situation is a test for the pilot as well as the airplane. He is tested for his ability and flying skill, his judgment and nerve and, above all, he is tested for his knowledge of the aircraft he is flying at the moment.

If you fly a twin-engine plane, how close are you to losing one? A MATS navigator who worked the Pacific for 3000 hours in four-engine stuff, reported that in 90 missions an engine was shut down on 13 of them. These missions average 33 hours and we can assume some shut-downs were precautionary, not emergency-type failures; nevertheless it comes out to one every 230 hours of flight.

"Twin" pilots are making one-engine landings every day but the failures are further apart. In 1963, for example, S-2 aircraft experienced 95 engine failures. Compared to approximate flight hours, this breaks down to well over 2000 hours between failures. Significantly, an engine failure seldom results in an accident: The number of engine-caused accidents for the S-2 type in 1963 can be counted on the fingers of one hand.

So even though we have hundreds of engine-out situations each year, few culminate in an accident. In fiscal 1962 the Navy's twin-recips flew an average of over 300,000 hours between engine-caused accidents. Based on statistics, such an accident can almost be regarded as a freak, but don't be too quick to assume that the dragon has no teeth. There are plenty of hairy tales where the pilot has felt the hot breath of disaster before making it safely to a runway. And there are still those engine-out accidents to consider. As few as they are, they cannot be ignored.

Can we turn them to advantage? This is high priced experience and a look at the causes of some engine-out accidents may prevent someone else from "paying the bill."

First, it will probably not be very surprising to find that violation of basic rules led to a good share of the accidents:

- Secured the wrong engine
- Unable to maintain directional control or altitude
- Attempted single-engine waveoff too low or too slow
- Dropped gear and or full flaps too far out
- Failed to add full power on initial failure
- Excessive delay in feathering
- Delayed retracting gear and or flaps

Next, as might be expected, the accident reports contained recommendations which are essentially basic:

- More single-engine familiarization time during check-outs
- More single-engine practice after check-out
- Follow published procedures
- Use proper techniques

A third point was somewhat unexpected and concerned the number of recommendations for more information on single-engine operations. It is perhaps

noteworthy that for one model of aircraft several reports said additional single-engine testing was needed.

Do we have a problem without realizing it? Have we been getting by on luck rather than skill? The pilots involved, both student and designated aviator, do not sound like the two percent who never get the word. In fact, except for isolated individual weaknesses, the group appears to be fairly representative and typical.

It is then reasonable to ask, "What caused the accidents?" While the reports generally point the finger at the pilot, details within the report often mark the spot where he stumbled. The following excerpts from accident reports cover some of these areas.

Planning

"Considering the marginal single-engine performance of P-5 aircraft, it is disturbing to note that due to simple computation errors the crew underestimated the aircraft gross weight by approximately 3000 pounds."

Forgot

"A single-engine situation in the A-3 is relatively routine based on the plane's known performance. The failure to retract speed brakes after securing the port engine was a major oversight on the part of both pilots and . . . turned a routine situation into a very serious one."

Preparation

"It is doubtful if the pilots were aware of the excess weight, number of passengers, amount of cargo, or lack of emergency briefing prior to takeoff. The apparent haste, coupled with the idea that the C-117 is an 'old and reliable' aircraft that is very 'forgiving' of any error in flight technique or violation of safety practices probably contributed to the accident."

Oops!

"Most probable cause of this S-2 accident was the turning off of the starboard main fuel shut-off valve by the copilot which resulted in a starboard engine failure. A rough running port engine had been already feathered. One contributing factor . . . is the design of the main fuel shut-off valves which makes it difficult to visually distinguish between the ON or OFF position at night."

Procedures

"The runway was sighted, landing gear lowered and shortly thereafter full flaps extended. The C-117 descended from 800 to 500 feet above ground level. At this time the pilots decided they had too much altitude considering their relative position to the approach end of the runway. They reversed their previous decision and elected to execute a waveoff. This decision was in direct violation of the emergency procedures in the Flight Manual: 'Do not lower more than half flaps until certain that a safe landing can be made.' Until the crash occurred the copilot tried to retract the landing gear two or three times, going through the complete sequence each time."

Information

"The S-2E NATOPS Flight Manual may contribute to pilot complacency by limiting its discussion of engine failure in Section III, Emergency Procedures, to the simplest case, propeller feathered. All conditions that may aggravate the emergency (windmilling prop) should be thoroughly discussed."

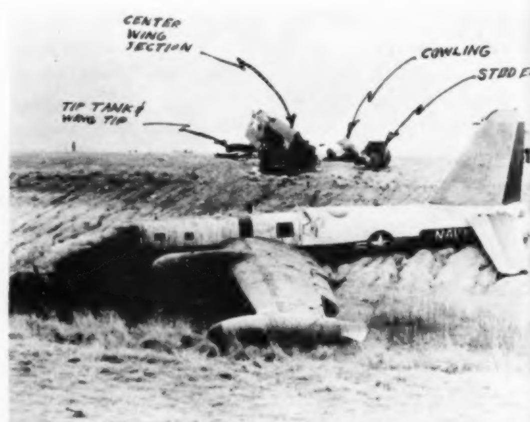
Oops!

"Primary cause of the accident was personnel error in that the wrong propeller was feathered."

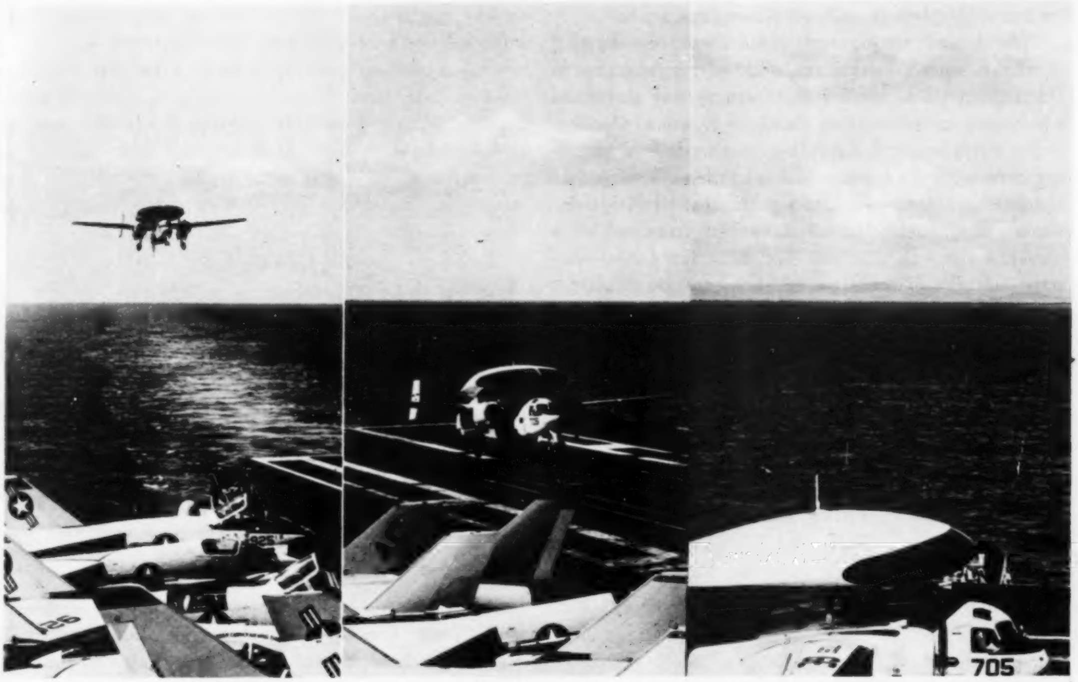
Practice

"The combination of full flaps and lowering the landing gear at the 90-degree position vice the straightaway resulted in the S-2 being at approximately 300 feet instead of 500-600 when entering the straightaway. It was necessary for the pilot to raise the landing gear to prevent the airspeed from dropping below the critical point. No practice single-engine carrier approaches had been made in almost a year.

"Although this squadron had been embarked for



No jets were available to the pilot of this P-2H on a night single-engine approach. Full flaps and low airspeed led to loss of control before the field was made.



An E-1B of CARAWRON 12 comes aboard USS SARATOGA with one engine caged. Port engine was lost shortly after cat shot. Pilot dumped fuel and with ready deck 10 minutes away, elected to make arrested landing rather than divert. Final approach was with 1/3 flaps and 105-110 knots. No. 1 wire caught.

such a large percentage of this period that FMLP was not required from the standpoint of normal landings, FMLP does provide the only means for practicing single-engine carrier landings."

Procedures

"Neither the pilot nor the copilot was prepared for the engine failure. When control was regained, the aircraft was well off the runway heading and the approach was abandoned. Instead of attempting to maintain altitude and immediately raising the landing gear, the pilot nosed over. As a result the P-2 was flown into a position from which there was little possibility of recovery. Of considerable consequence was the fact that the accident occurred during darkness."

Training

"The copilot was questioned in detail in regard to problems of control of the S-2 aircraft. He stated that when the pilot first called for assistance, the control yoke was full to the left, but that the left rudder pedal was depressed only 1 - 2 inches. He did not observe the position of the ball. Information available to the board indicates that neither pilot had simulated a single-engine procedure or actually feathered an engine during recent flights."

Technique

"Primary cause of this P-2 accident is attributed to pilot factor. He erred in aeronautical judgment when the field was considered made at a position of 500 feet above touchdown and in excess of 1000 feet from the runway threshold. The unnecessary use of full flaps at this point accompanied by the rapid deterioration of airspeed are attributed to faulty technique. These errors in technique were further compounded by the neutralization of rudder . . . followed by full application of asymmetric power."

Proficiency

"Although the pilots involved exhibited a working knowledge of the applicable emergency procedures, their response was not automatic in regards to the memory items. It is recommended that a random survey be conducted to determine pilot proficiency in this area and if additional training emphasis is warranted."

Continued next page

Non-Standard Situation

"The board recommends immediate reevaluation of all VS squadron training and safety programs to ensure that pilots are aware of emergency situations which require other than standard reaction. Because of the attitude of the aircraft on engine failure (clearing turn with 20 degrees of bank) there was neither altitude nor time available to feather. In this instance, immediate feathering might have saved a life, but since this is contrary to training and doctrine, no pilot error factor has been assigned."

Confusion

"The data based on full takeoff power on the good engine appears to indicate that the E-1 was being flown with a 2/3 flap setting when the accident occurred. Under Mission Planning in the NATOPS manual where increased flap settings are recommended for lower airspeeds, a statement should be added that this provision does not apply to single-engine operation. While NATOPS and the Flight Manual recommend 1/3 flaps for single-engine operations, it is felt that a pilot could confuse the twin and single-engine procedures."

Knowledge

"Once on the runway, a most serious, almost fatal, error in judgment was committed in attempting, even for a moment, to waveoff in an impossible condition for a P-2 (one engine feathered, jets inoperative, gear down, flaps extended, gross weight approximately 58,000 pounds)."

Aircraft Performance

"The pilot reported a sump plug warning light and loss of torque pressure. He did not feather the engine at the time he declared the emergency (state 2000 pounds) and subsequently ditched. On the day following this accident another squadron E-1 experienced starboard engine failure at 500 feet. The configuration was similar to the ditched aircraft.

"The propeller was feathered and fuel was dumped to 2000 pounds but the pilot was unable to maintain altitude using straight and level flight. After dumping to 800 pounds, altitude was maintained. In view of this incident, the board feels the pilot of the ditched aircraft could not have maintained altitude under the existing atmospheric conditions and fuel load, even with the port propeller fully feathered. This opinion is in variance with the single-engine maximum climb curve in the Flight Manual."

There are an awful lot of goofs in the preceeding paragraphs. But who is so bold as to throw the first rock. You could say there is a fine line between precision and prang when operating in the red-bordered pages of the flight manual. It is easy to trip over a detail.

Some pilots have been quite literal when announcing "I've lost an engine." A-3 characteristics were not much affected compared to recips with "flat plate" effect of firewall.

Take the matter of having the field "made" before dropping full flaps. Several accident boards have given a tentative position to be at before assuming this vital factor to have been accomplished. Is it possible to define a position where you have the field "made?" Have you ever given it any thought when applied to *your* airplane? Do you have a mental picture of what the runway lights should look like—darkness complicates things.

If gear and flaps are down what is the point of landing commitment in speed and altitude above ground where a single-engine waveoff becomes marginal or impossible. A review of multi-engine flight manuals and NATOPS shows that this piece of information is not always included.

It used to be a universal rule-of-thumb to make the single-engine approach just a "leetle" on the excessive side: carry a tad more altitude, a touch more airspeed, and hold the gear past the normal position. Now there is no more universal rule.

The flight manuals vary; from "same as normal" (C-47), to "tighter pattern may be flown" (C-131), to "1½ times as wide" (S-2). Watch out for habit interference if you fly more than one model of aircraft.

Practice and proficiency in single-engine operations go together. "Periodic simulated single-engine procedures are necessary practice for the successful handling of a real emergency," said one accident report and the philosophy is echoed in others. What do you practice and how do you practice? Simple work in recognizing which engine is out is not wasted effort. Wrong engines have been feathered. In securing, the wrong mags have been turned off, the wrong fuel supply shut off, the wrong emergency shut-off valve turned.

Haste can compound trouble so the method of deliberate action in identifying and securing has always been encouraged. In one S-2 "wrong feather" accident, the board felt that the failed engine gave a surge of power prior to its collapse and misled the pilot at the controls. The copilot was too quick to get his feet on the rudder and assist the pilot and this confused the issue even further. Result: A night landing in a farm field, fortunately without personal injury.

Haste has had another meaning in several accidents. "If nothing drastic is happening at the first indication of an emergency," said one board, "the prudent pilot may well 'hold what he has' for the few seconds needed to better analyze the emergency before placing himself in an untenable position by too hasty action." This reference was to securing an engine before the possibility of continued flight was assured. "Untenable position" means putting the pilot between a rock and a hard place.

It becomes necessary to secure the engine immediately in the case of fire or violent vibration. But is a fire warning light a fire? At low altitude, low airspeed what should be done first—get some speed or altitude or secure the power plant?

With four engines on the line, a warning light is assumed to be a fire until proven otherwise. The EC-121 NATOPS provides an example of immediate feathering.

With only two engines, the S-2 for instance, a warning light is treated as such, and conditions verified through use of engine instruments or confirmed visually. The decision to feather is wrapped up in words like "judgment, circumstances, conditions," and is then presented to the plane commander.

If we attempted to reduce the subject to a philosophy it would be something like this: "The fewer the engines, the more you want to cross check before shutting down."

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Accident board said pilots were in too much of a hurry to get down when port engine had to be feathered. Straight-in approach was requested and tower offered nearest straight-in runway due to urgency of request. Downwind landing ended in ditch off end of hard surface.

The P-2 is a sometime four-engine model which is usually operating only on the two recips. At altitude a fire warning light is good enough cause to feather—at least there are few criticisms of this procedure in the incident reports—because there are a couple of jets in reserve. A good illustration comes from a P-2 incident: "While climbing a loud backfire was heard on the starboard side at 2500 feet. No abnormal engine instrument indications were noted except that the starboard fire warning light came ON and remained on until the power was reduced on the engine. The jets were placed in standby by the copilot immediately after the backfire.

"A visual inspection revealed holes in the inboard and topside of the starboard cowling. The jets were started, using the airstart procedure and the starboard recip feathered."

What then? How far ahead do you think? There may be a temptation to slide on into home plate if no complications appear to be developing. Another P-2 incident shows it can happen. On a night fam a third takeoff had been made at Glynco. Approaching 1000 feet altitude the port engine began backfiring accompanied by a partial power loss. The after station reported it appeared that there was fire on the inside of the cowling and that sparks were being emitted in great quantity.

The engine was secured and the prop feathered. "*Return to NAS Jacksonville was made without further incident.*" The distance was not great, only 70 miles, but it doesn't sound right considering all the publicity given to the idea of landing at the nearest suitable field.

Somebody must have put out the word. Three weeks later another P-2 from the same squadron was 40 miles at sea when a fire warning light appeared. There was no evidence of fire on either the instruments or visually. However, the engine was secured as a precautionary measure. "An uneventful landing was made at Mayport." It is less than 20 more miles to home base at NAS Jacksonville, but Mayport was the first suitable field and that is where the airplane was put. Overcautious? Perhaps, but the only people who should gamble are those who can afford to lose.

And how about this kind of planning ahead: "Due to severe crosswinds at NAS Norfolk, the pilot elected to land at NAS Oceana. A successful single-engine landing was completed without further incident."

Conversely, lack of planning was evidenced in an S-2 accident where winds were not taken into account.

Smoking rubble was once A-6. Crew ejected safely. After single-engine waveoff pilot turned downwind and dropped both gear and flaps. Loss of altitude followed.

Due to backfiring and loss of power one engine was feathered. The copilot called a nearby military field and asked for an emergency straight-in approach "from present position, approximately five miles north." Due to the wording of the request the tower operator assigned a runway which gave a straight-in approach (runway 19) and gave the wind as 030 degrees, 20 knots. Neither pilot nor copilot caught the implication. So they came sailing in with a tailwind, landed long on the shortest runway on the field, and went off the end into a ditch. Elapsed time between initial call-up and touchdown was about two minutes.

Previously, it was asked, "Is a fire warning light a fire?" In the same vein we can ask, "Is a sump warning light an engine failure?" What should be done about it if no other indications appear to substantiate the warning?

As with the fire warning light, the philosophy for the sump warning light seems to be, "The fewer the engines, the more you want to cross check before shutting down."

A handfull of incident reports which originated with a sump light and no other indications breaks down as follows:

- With four engines, a sump light, or chip detector light is generally a signal to feather without

A small broken spring on the landing gear latch is believed to have led to this unsuccessful single-engine waveoff. The right seat pilot brought the flap handle up—but only to the neutral position. His attempts to raise the gear were unsuccessful. C-117 hit with full flaps. Fortunately, no fatalities.

delay.

• In 19 P-2 incidents 16 pilots feathered without any apparent delay. Three reports gave favorable endorsement to this action. One did not. Most contained no comment on the decision to feather. The mood generally appears to be "for" feathering; however, equal time is given to both sides.

For: "Squadron doctrine prescribes a precautionary feather when a sump warning light illuminates to preclude further damage to the engine unless safety of flight necessitates further use of that engine."

Against: "A sump warning light illumination by itself, with no other failure indications, does not require feathering an engine. However, under ideal . . . . conditions . . . timely feathering can reduce further engine damage and the danger of a serious inflight emergency."

When dealing with twin-engine aircraft the mood is "against" immediate feathering. Of 21 incident reports 12 showed the pilots did not secure the engine until on the ground; some did reduce power while airborne. Four crews reduced power when the sump light came ON but waited until another indication appeared before feathering. Only 5 pilots immediately secured the engine with simply a sump light showing.

While there may be variances in handling the engine, the crews were practically unanimous in discontinuing their schedule. Only two out of 40 pressed on regardless. In one case it was a false sump warning light but in the other case the engine failed several hours after the light came ON, with nearest landfall 400 miles ahead. There is some doubt that initial illumination of the sump light was actually an indication of a malfunctioning engine; however, the Disassembly and Inspection Report (DIR) noted that pieces of the failed engine components were found in the rear oil sump.

In case you do not have a clear course charted for yourself in a similar situation the criticism leveled at both pilots who kept to their original flight plan may give a clue. "The decision to overfly rather than land at available fields enroute is not considered sound," said one endorsement. "The plane commander exhibited poor judgment in his election not to land at (the nearest suitable field) with the chip light energized," the other report said.

These judgments are not necessarily harsh when considered as just one part of the whole engine-out subject. They, and some of the other judgments previously mentioned, should make good sense to a multi-engine pilot.

When horsepower is lost the difference has to be made up with horse sense.

Short Snorts

No one plans to fail. It's just that some fail to plan.

Low Level Bird Collision

During a high speed, low level run-in, an A-4C pilot spotted a bird just a split second before it shattered his starboard windscreen.

The pilot received minor cuts and scratches on the neck and right shoulder, plus a broken helmet visor, as part of the bird and pieces of the windscreen blew into the cockpit.

Engine instruments were reading normal as the pilot reduced power and began a slight climb. Then the cockpit filled with light smoke and the generator failed. The smoke cleared up in a few seconds and the pilot deployed his emergency generator. He then proceeded to his departure field and landed without further difficulties.

Use of the helmet visor during low level flights had been recommended in a squadron briefing just five days prior to this incident. Had not the visor been used in this instance, it is not hard to conclude that serious injury and a possible catastrophic accident may have occurred.

F-8 to A-4 Transitional Hazard

Same location of F-8 wing position handle and A-4 canopy release handle and similarity of control and direction of movement present possible hazard for pilots transitioning from F-8 and A-4 and for utility pilots flying both types.

Long Flight Stretch

Multi-fan types will find it's a good idea to get up and stretch a few minutes before starting a letdown following a long flight. Oftentimes there is an instrument approach waiting at the destination. Physical and mental activity is improved when a good circulation of blood is cruising around in the body.

—*ALPA "Tech Talk"*

Reaction from A-4 type: Yuk, wheez, scoff, snorf, barf, whuff!

Shortcut

The story of line equipment locking horns with parked, defenseless aircraft is an old one—but as long as the action continues, the tale bears repeating.

This time it was a flatbed versus a *Beech*. The truck driver, a well-qualified petty officer, drove up to the aircraft with a load of parachutes, passed behind the tail from starboard to port, and then cut in toward the access door. His turn was either too soon or too abrupt because it resulted in a crunched port rudder.

Here is a situation in which a capable man apparently drove his vehicle into a very limited area without being cautious enough to avoid hitting an aircraft—and we may well wonder how come.

Certainly there may be circumstances in which a man might be justified in attempting to speed up a job or even save himself a few steps but shortcuts around aircraft often produce results similar to or worse than the one we have here.

Lofted Rocket Launcher

During the first practice loft bombing maneuver following rocket firing practice, a FAGU "Pipe Organ" was unintentionally jettisoned from an A-4B.

The pilot had not secured his center line stores selector switch after completing the rocket runs. His lack of familiarity with the ordnance electrical circuit in A-4 aircraft contributed to this mishap because he believed that the rocket launcher could be jettisoned only by the emergency system.

It is absolutely essential that pilots be familiar with the ordnance electrical circuits in their aircraft and that they realize the importance of using the ordnance checkoff list.

HMH-461 UNSAFE GEAR TECHNIQUE DURING HOVER

The port wheel of the CH-37C had been damaged and wouldn't lock down. The crash crew and maintenance personnel attached a chain around the gear and hooked the truck crane cable to it. Steady pressure was provided by the truck's winch until the aircraft could be safely landed and a jack installed.

It is particularly noteworthy that the hook-up was accomplished after the aircraft, with a 3800 lb radio jeep aboard, had lost its automatic stabilizer and had declared a low fuel state. Timely coordination of maintenance, crash crew and pilots prevented the above incident from being an accident.

Mixed Blades

TWO tail rotor blades of an SH-3A were slightly damaged in a recent aircraft handling accident aboard ship.

The SH-3A was spotted close to the starboard edge of no. 3 elevator on the hangar deck level. An S-2 was spotted on the flight deck abeam this elevator in such a manner that the propeller of its no. 1 engine overlapped the elevator. When the elevator was raised to the flight deck level, the chopper's tail rotor, blades struck the S-2's propeller.

The primary cause of this mishap was personnel error. There were four separate errors made that added up to this mishap. *A correction of any one could have prevented aircraft damage.*

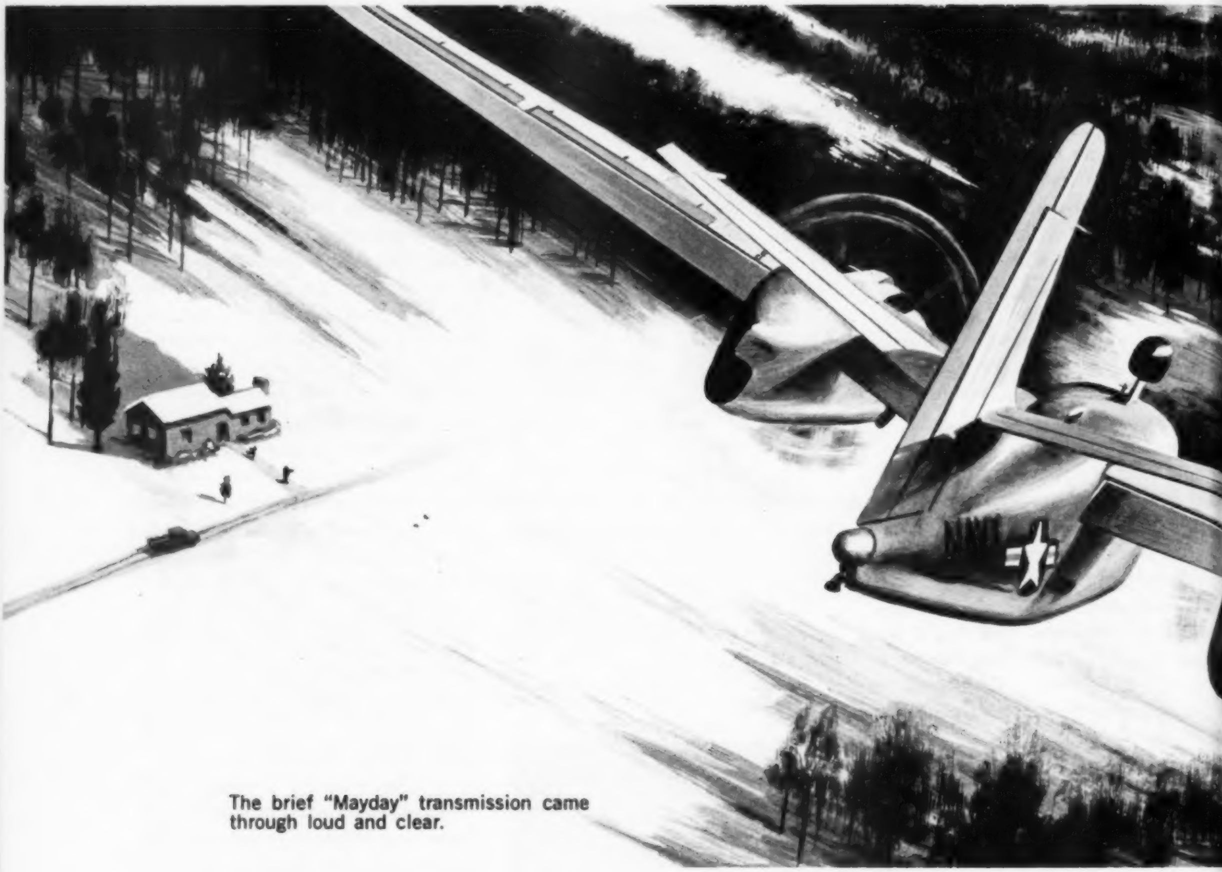
1. The hangar deck crew spotted the helicopter too close to the starboard edge of the elevator for adequate clearance. Only one helo was placed on the elevator and it could have been centered.

2. The elevator operator and plane director did not ensure that there was adequate clearance before raising the elevator.

3. The S-2 should have been spotted so that no portion of the aircraft overlapped the elevator. The existing placement of the S-2 aircraft increased the probability of a mishap of this kind.

4. A flight deck director had been warned by the flight deck officer to exercise caution when using the elevator because the S-2 was overlapping. He did not pass the warning to the director on the scene at the time of the mishap.

Caution in aircraft handling is usually the norm in carrier operations. However, moments of laxity in both caution and teamwork often result in this type of aircraft handling accident.



The brief "Mayday" transmission came through loud and clear.

INVISIBLE TRAP

TRUTH and CONSEQUENCES

It was uncomfortably cold, but the pilots preflighted the *Stoof* thoroughly before climbing in. Engine start, taxi and runup was smooth and professional. Apparently, these men knew the plane well. The pilot had over 1700 hours in the S-2 while the copilot, no novice himself, had nearly 600 hours in the sturdy little bird.

A little snow and ice remained on the runway but otherwise conditions seemed perfect for flying. Takeoff into the clear, crisp Sunday morning sky was uneventful. It looked like a great day for flying. Visibility was outstanding and everywhere below, the earth was covered with a mantle of snow. Just the right setting for Christmas, which was only 10 days away.

Item by item the equipment listed on the test form was operated and checked off satisfactorily. Only three minor discrepancies were found on an otherwise perfect test hop. After completing and

signing the test form, the pilots began letting down, headed for home. It would be a short flight—just over an hour.

The pilot was adjusting his throttles for level off when the first indication of trouble was noticed.

The brief "Mayday" transmission came through loud and clear, ". . . . north of the field, not developing power, may have to set it in, EMERGENCY." These words were the first and last heard from the aircraft during its final flight.

The crash site was in a swamp only three miles northeast of the field. The *Stoof* was seen and heard by witnesses for nearly a minute before it hit. During this time, it was flying very low. Both engines were running, but one or both were sputtering or running rough. One man said he heard the engines going out and coming back in, then nothing, then a very loud "bloop," then silence again just before the crash. Another witness said the engines were making a steady coughing sound as if at low power, while someone else thought the pilot was revving his engines. All witnesses agreed that the engines noises suddenly diminished or ceased altogether just before the plane dipped into the trees.

After clipping through tree tops for nearly 100 yards, the *Tracker* veered sharply to the right and plunged nose down into the swamp. There were no survivors.

An extensive amount of evidence was available to the investigators even though a small, persistent ground fire developed following impact. The engines and cockpit area were relatively intact.

Apparently, the aircraft crashed because it was not developing sufficient power on either engine to stay in the air. All the evidence, including the Mayday transmission, supports this general conclusion.

Under the existing conditions of aircraft weight, temperature, altitude and weather, the aircraft could have remained airborne with either engine dead and windmilling—provided the other engine was developing full power. However, the pilot's radio transmission did not indicate a power loss on a specific engine or even that he had lost an engine.

The pilot, who had flown nothing but S-2s for the previous 1700 hours, did not turn on the single engine rudder assist—the first memory item in the NATOPS procedure for action to be taken upon encountering failure of one engine.

Neither propeller had been feathered and each engine was operating with little or no power upon impact. There was no evidence that the pilots had attempted to shut down either engine or that they had taken any action peculiar to a single engine loss of power as opposed to a dual loss of power.

Finally, the DIR revealed nothing that would have caused a failure of either engine.

In the light of this established evidence, the Accident Board concluded specifically that neither engine was capable of normal operation prior to the crash.

The board went on to state that, except for freak failures of essential components, there are few things that can cause a simultaneous loss of power on both engines. The fuel selectors, ignition switches, and all engine controls were properly positioned to provide power from each engine. Oil and fuel samples met the required specifications in laboratory analysis. No water was found in the preflight fuel samples and the aircraft had apparently operated normally for one hour prior to the accident. Also, the recovered flight test form was signed off only 13 minutes prior

to the emergency transmission, indicating a satisfactory completion of that portion of the hop.

Carburetor ice is virtually the only factor that could cause a loss of power on both engines without leaving any real evidence afterward. The conditions for carburetor icing were ideal; there was only a 16° temperature-dew point (23° F and 7° F) spread with a relative humidity of 52 percent.

Since the aircraft was on a test flight, it would normally operate at 6000 feet or above, for that portion of the flight. Had the aircraft been operating without alternate air, a low power descent from altitude could permit carburetor icing during descent. If this was the case, the normal first indication of carburetor ice—a gradual loss of manifold pressure—could have been masked by the gradual increase of manifold pressure that normally occurs in a descent with a constant throttle setting. A loss of power due to carburetor ice under level cruise conditions would have been much more noticeable.

With the addition of throttle to level off at a lower altitude, carburetor icing could have prohibited sufficient power for flight. That this may actually have been the case is indicated by the fact that the aircraft crashed less than two minutes after the emergency was declared. Also, full alternate air had been selected on both carburetors, indicating that the pilot considered his power loss to be due to carburetor ice.

It is generally agreed that full alternate air is not required to prevent carburetor ice in the S-2. However, the system is designed primarily to prevent ice formation and therefore it is desirable to select alternate air prior to encountering icing conditions. Under cruise conditions, carburetor ice would have probably been detected early enough to prevent an emergency situation. Poor weather conditions, with visible moisture in the atmosphere, may have alerted the pilots to the possibility of carburetor icing; but on a clear, crisp, cold day, with outside air temperature below 0° C and with visibility over 15 miles, it appears that these pilots overlooked the possibility just long enough to get trapped.

The board concluded that the suspected primary cause factor, based on circumstantial evidence, was carburetor icing, with weather as a suspected contributing factor. It recommended that:

- All pilots be continually briefed on the dangers of carburetor ice and the proper procedures for avoiding it, as covered in BuWepsInst 13460.2 and applicable NATOPS manuals.
- Pilots of multi-engine aircraft be rebriefed on emergency procedures to be followed in the event of complete power failure or partial power loss on all engines. These pilots might have survived had they concentrated on selecting an emergency landing area rather than on getting home.
- The possibility of encountering carburetor ice in the absence of visible atmospheric moisture be particularly stressed.
- All S-2 pilots be rebriefed in the necessity for scanning the carburetor air temperature gages on the copilot's instrument panel.
- Continued emphasis be placed on the necessity for proper wearing of flight gear by all flight crews. Both pilots lost their helmets in this accident, either due to improper fit or loose chin straps.

Although circumstantial evidence indicates that induction system icing probably caused the emergency that preceded this accident, the primary cause must officially remain undetermined. Pilot technique (misuse of engine controls) was considered a probable contributing factor.

One endorser's comments contribute to the investigation of this accident and provide a fitting windup to this episode. . . .

"Although it is possible that the aircraft was operating at altitude during the test portion of the flight, without alternate air, it is also possible that sufficient alternate air was selected to properly maintain the carburetor air temperature within prescribed limits. If this had been the case, a long (5000 feet or better) low power descent from altitude may have allowed the cylinder head temperature to drop so low that adequate warm alternate air was not available to maintain the carburetor air temperature within prescribed operating limits, thus allowing the subsequent build up of carburetor ice."

He went on to say that, "If we accept as fact that carburetor ice was the cause of this accident (and there seems to be no alternative), then the following question stands brazenly before us: '*How* is it possible for two well-qualified pilots, with a wealth of all-weather experience in model to allow themselves to be trapped by such a well known hazard? *How* is it possible, on a clear and sunny Sunday forenoon, for such a tragic and unnecessary loss of life and equipment to occur?' The answer must be that nothing is more dangerous in aviation than that *false sense of security*, with its resulting letdown, that is so apt to embark on a routine local hop on a beautiful day."

LSO RADIOS

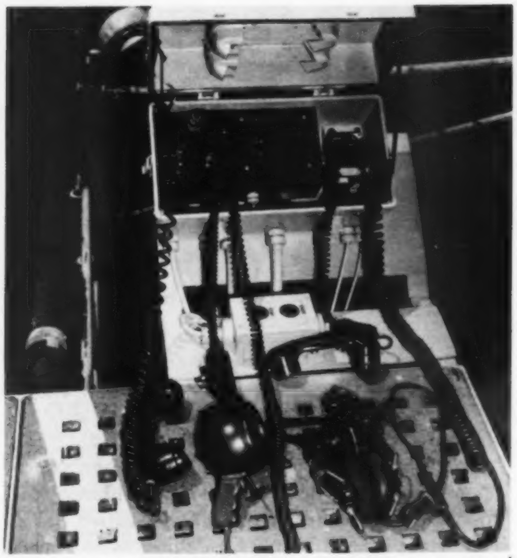
The Indispensable Right Hand

By LT Ray Riches
VS-38

In this age of sophisticated carrier optical landing systems, LSOs and pilots who are qualified in the paddles approach have almost become a thing of the past. Now that the pilot's attention is no longer focused upon the platform, the LSO-to-pilot visual signals are totally inadequate as a means of communications. As an unobserved observer, the LSO must convey advice and assistance via the radio. An LSO without reliable radios is as much on the spot as a lifeguard with a broken right hand. With the remaining hand firmly clutching the waveoff pickle he can generally prevent a dented flight deck; however, his ability to render assistance to the man in the groove, who may need or desire it, is seriously impaired.

LSO controlled ship-to-air communication systems which possess low material reliability, limited flexibility, and absence of back-up facilities will invariably—given proper feeding (X number of recoveries) —breed a multitude of undesirable recovery situations. Color them hairy!

The LSO staff aboard one Pacific Fleet CVS was plagued with inopportune and repeated communication failures and deemed a face lifting was in order.



LSO commconsole on LSO platform on CVS-20, gear rigged.

The communication facilities originally provided at the LSO platform consisted of:

1. An RRS (remote radio station) set on land launch and shared with PriFly and AirOps. (No flexibility here; due to the time required by Main Comm to change frequencies and the resulting inconvenience to other stations, the radio remained on land launch and was usable only during day VFR recoveries.)

2. An LRS (local radio station) consisting of a four-position barrel switch providing APCON, DEPCON, FINAL and a 10 preset channel radio as fourth position. The LRS system is CATCC controlled and can be shared with the LSO, PriFly and one additional station in CATCC. (Only a marginal backup facility for the LSO here; peculiarities of the system prevented the LSO from monitoring CATCC's outgoing traffic. Also, if more than two of the four control stations had the same LRS position selected at one time, the LSO could not transmit.)

3. An AN/ARC 27 which was located in a radio space adjacent to the platform. This 18-channel unit was powered by an AC-DC Transformer Rectifier and featured remote controls at the platform. (No material reliability here; the transformer rectifier predated most of the non-rated men—if not the author—and was prone to blow fuses, pop circuit breakers and generally fail at the most awkward times, thus rendering a fine piece of radio equipment unreliable.)

An additional problem at the platform itself was the location and accessibility of handset junctions, sound powered junctions and lighting facilities. Some of these were located as much as 15 feet from the platform. All handset and phone lines and their junction boxes were exposed to the effects of weather, saltwater corrosion and soot, plus the unintended abuse received from personnel tripping over, walking on and becoming hopelessly entangled in them at night.

The first step in face-lifting was to obtain a better 28-volt DC power source for the ARC 27. This was achieved by providing the radio space with 28-volt power supplied by a jet start motor generator located forward of the platform (frame 184, 02 level, port side, on most 27C types). A remote start-stop control switch was also installed at the platform. The old transformer rectifier was then rigged as an alternate power supply for the ARC 27.

The second step forward was the installation of a second ARC 27 in the radio space and a dual remote control box located on the platform. This essentially eliminated the necessity for the LSO to share radios with any other station.

The third step was centralization of all communications and lighting junctions and controls. This was accomplished by mounting a hinged top, weatherproof enclosure, the size of a beer cooler, on the after edge of the platform. Inside the enclosure was mounted a console containing the ARC-27 dual installation remote control box, a radio handset, a handset selector switch which can connect the handset to any one of the four radios available (either

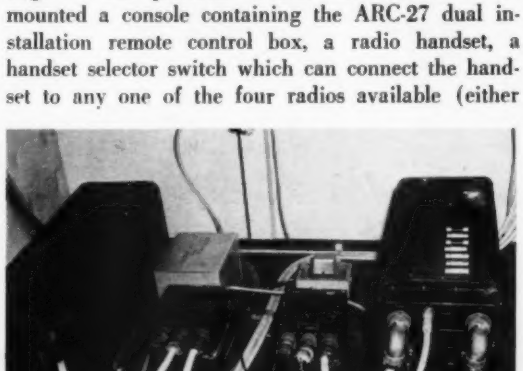
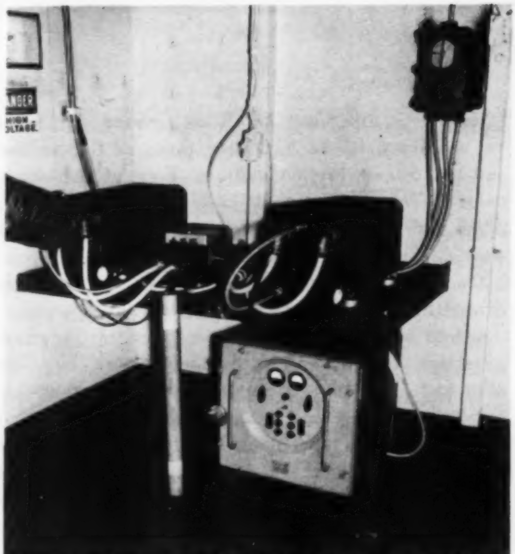


Photo shows an oblique view of the Dual ARC-27 installation.



This photo shows the entire below deck installation of the Dual ARC-27.

ARC 27, the LRS or the RRS), a handset volume control, a motor generator ON monitor light, lighting controls for panel and lid red lighting, two 28V utility outlets to service an Aldis lamp and an aircraft utility lamp (for the LSO's scribe).

The console mentioned above came from an old LSO Lighted Suit Equipment box (Grimes Part No. G-900-7). They are probably still in the supply system. Some of the original lighting controls were removed and others repositioned to permit adaptation to this installation. Adjacent to the console are located two sound powered junction boxes, one for the CATCC/LSO emergency hotline and one for the hook spotter's headset. Two standard handset holders are mounted in the lid to provide weatherproof but accessible stowage for the handsets (a spare handset is stowed in a gear locker located in the catwalk).

The enclosure used in this installation was originally a shipping and stowage container for electronic bench test equipment. Construction is of fiber glass with a rubber gasket around the edge of the lid opening. Four metal clamps hold the lid closed against the gasket providing a weatherproof seal during periods when the gear is not used. Any rugged weatherproof closure would suffice.

The hook spotter's soundpowered headset was fitted with a breakaway-fitting about 6 inches below the breastplate to preclude a hanging if he should be forced into the net by a close encounter with aircraft and/or rapidly exiting LSO.

The face lifting has provided outstanding material reliability in the platform hardware as well as the radios themselves. All external links between the radios and LSO's communication box were sealed, potted and painted to provide the best weatherproofing possible. All hand operated gear is now readily accessible, requires no rigging prior to recoveries and (with the exception of the Aldis lamp) is stowed in the same weatherproof enclosure from which it is operated.

The ARC 27 installation at the time of this writing has not experienced a failure in the five months of operating since completion of the installation. This is primarily due to the reliable 28-volt power source. Of course, the importance of adequate cooling for the ARC 27s cannot be overlooked.

Flexibility and backup facilities are now in abundance. Both ARC 27s have 18 preset channels, controllable at the platform. In the event of one ARC 27 failure, the other unit is available in the 60-second time required for warmup.

In the event of motor generator failure, the back-up power supply can be selected in less than one minute. The original LRS and RRS units serve as a third back-up to cover an unlikely total ARC 27 failure. If the LSO platform were destroyed, the ARC 27 could be operated from the catwalk by use of a jumper cable and headset or hardhat equipped with a boom mike.

The ARC 27 dual installation remote control box was the only part not carried in the ship's supply system. Two single radio remote control boxes could have been used in place of the dual remote control box. All parts used in the installation were standard stock items.

All work was accomplished by ship's force personnel. Outstanding cooperation from the ship's electronics shop and electrical shop enabled rapid achievement of each of the three desirable features mentioned earlier. Through concerted effort on the part of all hands involved, the project was completed between ConUS and departing Hawaii on West Pac deployment. The man-hours invested in face lifting have paid large dividends by drastically reducing the number of man-hours spent by shop personnel in emergency calls, troubleshooting and maintenance.

The most important dividend is, of course, the achievement of reliability, flexibility and accessibility of the LSO communication system.

A Personal Letter from CAG

Since I became your Air Wing Commander, seven months ago, we have had three fatal accidents and two known flight violations. Four of these incidents have one thing strikingly common: all the pilots had approximately the same rank and experience.

One accident, our only A-4 fatality, was probably caused by the pilot's strong desire to win a competition and by errors of sensory or planning judgment stemming from his limited pilot experience. This pilot had something in common with the other four but he was junior and less experienced.

The causes of our other two fatal accidents will have to be recorded as undetermined; however, in both cases the circumstances indicate that the pilot lost his life while engaged in a flight maneuver that was not a part of his mission, not authorized and which he had probably been told many times was unwise.

The pilots in these two fatal accidents and in our two recent flight violations all had these things in common—all were full lieutenants, all had completed at least one or more WestPac deployments, all had a wealth of experience and skill in the airplanes they were flying, all were on the "downhill" half of their first sea duty tours, all were graduating from the "nugget" stage to the flight leader stage, and their commanding officers felt that all were above suspicion of knowingly violating safe flight procedures. It is to this pilot category that I especially direct this letter. Obviously you are not alone in our Air Wing, or in naval aviation or at your home base in belonging to this category of pilots. And the senior pilots in the Navy are graduates, or survivors, of this stage in every carrier pilot's life. I am asking you to survive and to keep a clean flight record while doing so.

I am unable to define the wild emotion or random idea that may have led these four pilots to flirt with excess danger. Certainly, all of them knew better through training and indoctrination.

I suspect that they may have fallen prey to that feeling of invulnerability which often results from a

high state of proficiency coupled with love of flying and youthful exuberance. How often have you said "That can't happen to me?" If you are sticking to the rules, the odds are very high that *it can't* happen to you. If two of our lost pilots did break the rules, they are stark proof that *it can* happen to highly skilled and respected men when they disregard unforgiving aviation axioms.

If these four pilots had been judging someone else, they would have called their four incidents cases of poor judgment. All but one of the four might have been trying to impress others with a little showmanship—a reversion to juvenile thinking. If we want to impress others, especially non-carrier types, all we have to do is show them a day and night of routine carrier operations. Good carrier operations impress anyone. It is generally accepted as the most hazardous and demanding type of "routine" military flying.

I am not trying to suppress the "tiger" attitude in you. I am trying to convince you that there is enough challenge and danger built into our work to satisfy any normal appetite for thrills. I ask you to join me in the satisfaction the older pilots feel in fulfilling each mission of each flight safely and effectively and then debriefing the lessons learned—*and* the thrills.

If you have some idea why a trusted pilot would feel an impulsive desire to seek extra thrills, I would like to know about it and discuss it with you. It is the type of urge we must examine and understand if we are to prevent further loss of pilots like yourself.

Ask yourself, also, if you are above taking advice, listening to briefings or heeding warnings that you have heard hundreds of times before. This may be the time in your flying career when some parts of your flying duties are growing stale for you. If you feel this way, talk it over with your C.O., your safety officer, your flight surgeon, your wife, or someone else you trust. But *don't* let a stale attitude kill you.

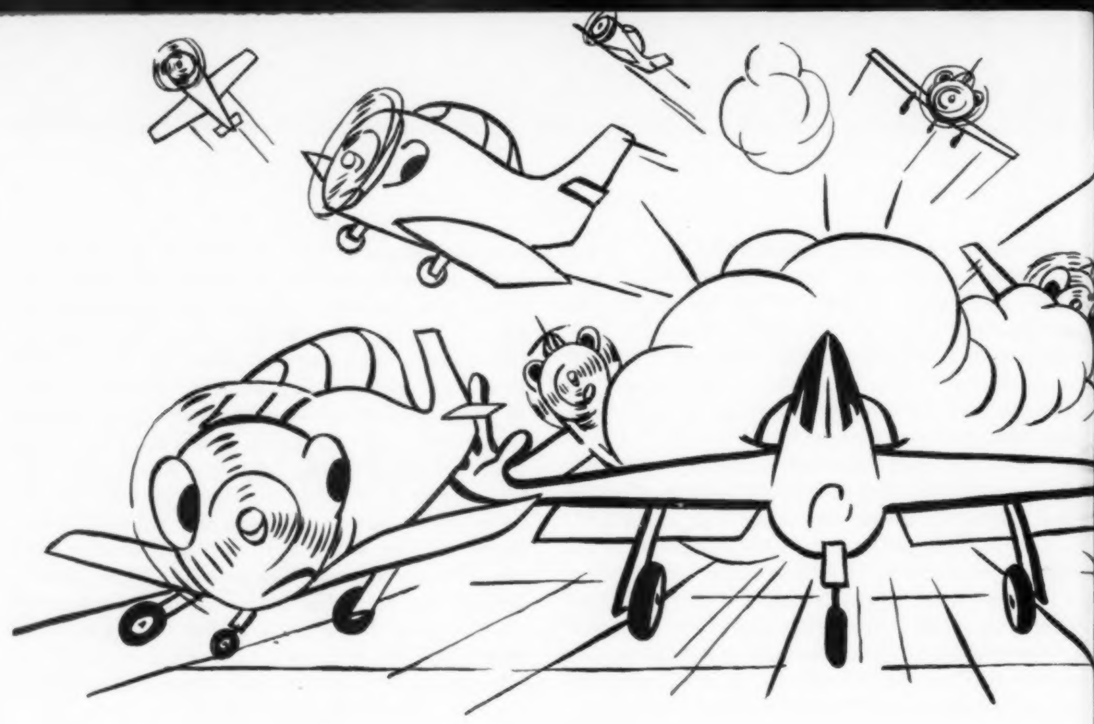
I am going to say something to you that I do not generally talk about. In addition to the other reactions I feel toward fatal accidents in our Air Wing, I feel a certain resentment toward the pilots who caused the accidents. It is not just resentment because I am the boss and they broke my rules. It's resentment because they may have been so good that their C.O.'s did not feel the need to caution them every day against taking undue risks. It's resentment because they make their ship, squadron, fellow pilots, crew and the Navy look bad. It's resentment because they deprived us of their friendship, and they deprived wives, parents and some tiny babies of a husband, son, and father. It's resentment because their accidents, and the grief they brought, did not have to happen. It's resentment because they have deprived the Navy and the nation of skilled fighting men and future leaders. And, they have made you and the other pilots of your rank and experience suspect in the eyes of their superiors.

This letter is a shot in the dark. I do not know that you are the proper target. I do know that officers of your rank and experience are of the utmost value to this Air Wing, to your squadron, to the Navy and the United States. Yours is the youth and skill, seasoned by your recent experience, that can put our bullets and bombs on the targets and impart fighting know-how to younger pilots. You bear heavy responsibilities. You know most of your responsibilities well. I want to emphasize that one of your major responsibilities is not just to fly by the rules but to survive by the rules.

I have tried to evoke emotion from you because I believe this is a time for emotion. I fear that fleeting aberrations in normally smooth emotional patterns may have cost us two outstanding young officers. Others may have risked their lives because some stray caprice impaired their normally sound judgment. If you feel any response to these thoughts at all, let your emotions feed your resolve for today and future days. Be a better, safer pilot every day.

When you man your aircraft you are the commanding officer of that aircraft. *Before* you man your aircraft, take command of *yourself*—that you may live to command other aircraft, and other men.

CAG



Hurevac

Anymouse Special

Two words of advice about a Hurevac—*don't go!* You might assume the duty, go on leave, get grounded, or take charge of the operations and send everyone else, but don't *you* go!

Having given you this valuable advice, I now must defend its value. To do this I will describe a Hurevac in which I took part recently. It was well planned. All pilots were well briefed. Everyone knew exactly what to do. The operation was a complete fiasco.

That was the big picture; now the details. I was stationed in Pensacola, instructing in the T-28. It was a typical, mid-summer day in the Training Command—hot, humid, miserable. Summer in Florida also means hurricane season. The weather bureau keeps an eye on all tropical storms and keeps the Gulf Coast prewarned of them. From these warnings the Training Command sets Hurevac conditions for all squadrons. Hurevac Condition III is set 24 hours prior to Hurevac. This is the time to evacuate.

A Hurevac sounded like fun, sitting around for a couple of days just eating, sleeping, and playing cards. Anything seemed better than four hops a day. So the stage was set. The warning came; and at 0430 we assembled for the launch brief. We had been prebriefed several times on where we were going, formations to use, etc. All we needed now was plane assignments and frequencies. The squadron had 120 aircraft without hangar space. There were 110 instructors, 20 of which quickly found reasons not to go. No problem—30 qualified formation students filled the gap.

At 1230 the operations officer plus seven launched for NAS Memphis. We were on our way. And every five minutes for the next ninety minutes eight more T-28s lifted off. The "great adventure" spirit was everywhere.

I was in the last flight and was airborne about 1400. The weather was marginal VFR with a thin, broken layer around 1700 feet. We were to stay underneath the weather, if at all possible. Terminal weather was forecast to be no problem in Memphis. Everything was still smooth and on schedule—300 miles of T-28s burning 25,000 pounds of fuel an hour.

Our flight was average. Two experienced division leaders, five instructors with no recent formation experience, and a formation student. The student had no problem; the rest of us found a comfortable parade position after 15 minutes or so. About this time the first flight was touching down at NAS Memphis. Another hour and we would all be closed out. It was to be a long hour.

We were not outrunning the weather. The ceiling, still broken, was down to 1200 feet. Visibility was poor with light showers. At this point we took the upper route, still expecting good weather at Memphis. Our armada was now in three groups: 1/3 on deck, 1/3 approaching low level, and 1/3 on top.

At this point Memphis reported IFR with field weather 900 feet, broken. The lower group commenced contact approaches. The upper group started saturating all available holding space. Radar monitor was impossible. Communication was hopeless. Still, everyone had plenty of fuel and we were VFR. We could even see the field from time to time. A short delay, an hour at the most, we figured.

Unfortunately, we were not the only group heading for Memphis. NAS Pensacola sent an assorted group of T-2Js, T-28s, SNBs, and a UF. Saufley Field added a few T-34s and a dozen T-28s. Tyndall AFB was represented by 20 F-102s with 20 to 30 minutes' fuel remaining. Somehow we all squeezed in and awaited instructions. By this time all lower traffic was on the deck and actual approaches started.

There was quite a delay getting organized and the jets started calling "low fuel." This started it. Now everybody had a problem—more radio confusion—Navy versus Air Force, jets versus props, everybody versus Memphis Approach Control. The jets had to come down, and two by two they were cleared in. It was now 1630 and the '28 drivers were tired and ragged. With the jets in, the props started in, two at a time. There were some strange formations. A UF joined on a Beechcraft. Another Beechcraft joined a T-34. So far, no T-28 from our group had started in.

Fuel now became a problem for everyone. Low fuel state became the only way to get a clearance. When this stopped working, a few declared emergencies. We were still spectators. There were now four aircraft in the emergency pattern. One conversation between F-102 and Memphis Approach was as follows:

"Memphis Approach, Air Force jet 309, low fuel state."

"Air Force jet 309, Memphis Approach, Roger."
(A few minutes later). "Memphis Approach, Air Force 309, 4 minutes fuel remaining."

"Air Force 309, Memphis Approach, Roger, Standby."
(Exactly 4 minutes later). "Memphis Approach Air Force 309, Commencing flame out approach." He made the runway and rolled by several T-28s like they were standing still.

A student landed a T-28 with high oil temperature and zero oil pressure. At the line they couldn't find a trace of oil. One by one the emergencies were handled, and it was all over but the shouting.

Everyone should have been issued a campaign medal. The Memphis Approach controllers should have received the Presidential citation, simply because everyone made it. It was luck! It was a modern miracle!

As I taxied in and shut down, my feelings were unexplainable. I was dead tired. I was elated. I wanted to kill an Air Force pilot. I found one and instead we got drunk together. It was no use trying to tell anyone the problems you had getting in. The first liar didn't have a chance. A tape recording would have overwhelmed the Anymouse Editor.

The hurricane hit Corpus Christi, Texas, 700 miles away. This was the final blow to our "great adventure" spirit—*never again!*

FLASHLIGHT ADRIFT

We had just completed one arrested landing and a cat shot without incident during our third consecutive night of carquals.

Following the second cat shot, the S-2's nose didn't want to come up. I struggled with the controls and maintained heavy back pressure on the yoke throughout the downwind turn. After leveling off downwind, I asked the CAPC if the elevators felt stiff to him also. They did. We climbed into the Delta pattern to try to figure out why, if possible, before heading for the beach.

I wanted to give the cockpit a careful check and reached for my flashlight. It wasn't there on the seat between my legs (where I always kept it during night operations). The CAPC gave me his light and flew the aircraft while I hunted for mine on the cockpit deck . . . not there, either. *Now* we knew what was probably binding the controls!

After unstrapping and removing such paraphernalia as my mae west, pistol and jacket, I unlocked the rudder pedal adjustment, pushed the rudders forward and, after practically crawling up under the instrument panel, I spotted my flashlight. It was resting against the fuselage skin, under the base of the yoke, forward of the port nose gear door. After a lot of squirming and wiggling, I finally managed to work the light into a retrievable position. We then resumed carqual landings and completed the flight without further incident.

On the way home, I mentally reviewed a recent similar incident in our squadron and also thought about the June 1964 Crossfeed article which told of an S-2 suddenly diving into the water from a position in the pattern about where our troubles had begun. The only words heard before his impact were, "*mayday, mayday, mayday —36, I can't—.*" Nobody alive today knows for sure what went on in that aircraft just before it crashed, but my own experiences that night gave me some definite ideas as to what may have happened.

In the debriefing, two other pilots pointed out that the skipper had recently ordered everyone to get lanyards on their flashlights—in response to our previous incident. For various reasons (all legitimate) I had missed the all-officers meeting at which this word was passed.

An interesting sidelight is that this incident was set up in part by my efforts to anticipate a possible emergency situation. Over the years, I had developed the habit of placing the flashlight between my legs, pointing at the instruments, figuring that in the event of a lighting failure, just off

The purpose of Anymouse (anonymous) Reports is to help prevent or overcome dangerous situations. They are submitted by Naval and Marine Corps aviation personnel who have had hazardous or unsafe aviation experiences. As the name indicates these reports need not be signed. Forms for writing Anymouse Reports and mailing envelopes are available in readyrooms and line shacks. All reports are considered for appropriate action.

—REPORT AN INCIDENT, PREVENT AN ACCIDENT—

the cat or at some other critical place in flight, I could instantly locate it and get light for the gages simply by flicking the switch. I had previously considered and discarded the idea of attaching the light around my neck by lanyard, thinking that this arrangement could possible hinder my escape from the plane in the event of a ditching. Besides, my own method was time tested—the light had ridden on the seat between my legs through many a night carrier landing.

I've taken the following corrective action:

(1) removed the flashlight from it previous position.

(2) attached a lanyard with a breakaway strip of the same material used to adjust flight suit waistbands.

(3) ordered a right-angle flashlight, as recommended by Captain Henry R. Vitali's letter in the "Letters" section of the July 1964 APPROACH.

(4) Passed the word!

No Bones About It

It was a lovely spring day in North Carolina; the pilot had been off-loading an LPH for the past four hours; and now it was time for some of those lovely (Ugh) flight lunches that helicopter pilots thrive on. The copilot took over and the pilot munched away, casually tossing out the window his olive pits, egg shells and other assorted garbage. On landing, suddenly the right wheel brake failed. Corrective action by maintenance was simple; and I quote from yellow sheet: "Removed chicken bone from brake assembly." Good thing it wasn't a T-bone the pilot threw out or we'd be replacing a gear. Cheeeeeeeze!

Air Starved Start

A plane captain had made the routine preflight inspection of the AF-1E and had given the pilot "Thumbs up" and was ready to commence starting. The pilot did not preflight the aircraft. If he had, there would be no need for this letter.

When the pilot began to turn the starter over, the engine seemed to work well enough, but when the fire was lit the engine overheated rapidly and smoke started pouring out.

What had happened was that in forgetting to inspect the intake, the plane captain had also forgotten to remove the intake cover.

As any plane captain knows, the first item of any jet preflight is to inspect the intake for obstructions, damage, or excessive wear of the compressor blades. Even an AA is taught this on his first day on the line.

As a result of this negligence, the engine and much of the aircraft had to be repaired, and the pilot and maintenance officer got pretty hot under the collar. Of course, the pilot had no gripe coming—his failure to preflight the aircraft was a contributing factor.

I think this pretty well emphasizes the importance of preflight inspections. Had the plug been a screwdriver or wrench, the pilot might never have realized it until he was off the runway, which, to put it bluntly, is a hell of a time to lose your engine. What was just an incident this time might well turn out to be a fatal accident next time around.

The Ears Have It. . . .

Do you *always* check the station identification signal when changing tacan channels? Chances are you may not because the tacan channel system seems so fool-proof. However, any system, no matter how perfect, may require an occasional helping hand from the pilot. This was recently discovered by two A-4 drivers.

These lads were tooling along on a cross-country to Washington, D. C., area from a west coast air station when they discovered that the NOTAM coverage (at their home base) of the East Coast area didn't indicate that several of the tacan/vortac stations had been assigned new frequencies. The enroute supplement and charts indicated in fine print that frequency changes were contemplated for these stations at a future date. To further complicate the picture, the old frequency of one station had been reassigned to a navaid less than 100 miles away.

The obvious result was a section of A-4s merrily cruising along towards the wrong navaid under IFR conditions. Thanks to alert ARTCC personnel the error was detected early and the situation resulted in nothing more than some well deserved embarrassment on the part of the flight leader.

A simple check of the ID signal could have prevented the whole fiasco.

Reader Questions Headmouse Answers

Have you a question? Send it to Headmouse, U. S. Naval Aviation Safety Center, Norfolk, Virginia 23511. He'll do his best to get you and other readers the answer.

Snaps Vice Laces

Dear Headmouse:

A recent near-casualty in our squadron has brought to light an important safety feature of a modification to flight deck shoes heretofore considered only a convenience. Several members of the squadron had the standard laces replaced by heavy duty snap fasteners, (the type on parachute bags, helmet bags, etc.) between the outer shoe and the tongue.

One of our line personnel recently suddenly found himself the only participant in a non-scheduled swim call with the carrier making tracks for the horizon. Since he had no flotation gear, his first thought was to remove his flight deck shoes which seemed to have changed to a couple of anchors.

Though the pucker-factor was extremely high, it did not reach the panic level. However, the amount of energy used in struggling with the tight, wet shoelaces was such that the man was near complete exhaustion when the helo showed up overhead less than 10 minutes later. The helo crewman had to enter the water and assist the survivor into a life raft while the chopper got into position. Then the crewman had to help the survivor enter the sling. The rescuee felt that an additional minute or two with those wet shoes—he never did get rid of them—would have been his last and he recommends that flight deck personnel be provided with break-away or quick release type foot gear.

The heavy duty snap fasteners on our shoes have proven durable and effective. Their potential value is demonstrated by the above incident. Total cost per pair of shoes is about 32 cents and 10 minutes of time. The savings could be one man!

J. MARR, AO1
VAH-11

▶ Two out of three parachute riggers at the Aviation Safety Center are personally in favor of the snap fasteners. The third, stating he could see no great advantage, pointed out that the snaps on his modified shoes sometimes came undone while he was working on the flight deck. There was general agreement that the kind of shoelaces used might have a bearing on the ease or difficulty of discarding laced shoes in the water, and that, generally speaking, snap fasteners can do no harm.

Very resp'y,

Headmouse

Oxygen

Dear Headmouse:

This Anymouse medical type was acquiring some night VFR time in the back seat of the trusty bug smasher near a Pacific Coast air station. The pilots were proficiency types assigned to the air station.

The early part of the flight was flown between 5000 and 10,000 feet but later the flight was continued at 11,500 feet. This mouse sucked occasionally on the oxygen tube and queried the pilots about using it as it is required above 5000 feet at night. Both pilots took it rather lightly and neither one used the oxygen at any time during the flight.

Both pilots smoked several cigarettes during the flight also.

This mouse noted definite increase in light brightness after sucking on the tube. You can bet that I kept a sharp watch as an airborne observer.

Apparently the effect of oxygen lack and CO from cigarette smoke has not been emphasized enough to all pilots. The regulation of 5000 feet at night was set up because a decrement in night vision occurs by that altitude. Cigarette smoke with its CO just aggravates the problem. A flight of four hours' duration as this one was is asking for trouble.

MEDICMOUSE

▶ Thank you for your letter. For further discussion of smoking's effect on oxygen and night vision, see "The Insidious Enemy," p. 26, this issue.

Very resp'y,

Headmouse

Pencil Flare Gun

Dear Headmouse:

I have heard some scuttlebutt that we are not supposed to use commercial pencil launcher flares. Can Headmouse clarify?

ANYMOUSE
—A

▶ Here's what BuWeps has to say on the subject: "Commercial 'Penguin' and 'Mayday' signals are not approved for service use. Limited approval will be granted on a case by case basis for direct commercial procurement for special test, evaluation or other such uses. Pending availability of the Mk 79 Mod 0 Kits, only authorized items such as the Signal, Smoke and Illum. Distress Mk 13-0 are to be maintained in service allowables."

Very resp'y,

Headmouse

Unstandard Instrument Markings

Dear Headmouse:

Aircraft Instrument Bulletin 5-54A sets forth the procedures for properly applying range marks on aircraft instruments. It stated, "In all aircraft, white arcs shall be used to indicate operating ranges and red stripes to indicate limits."

Its purpose is to standardize aircraft simply and easily; however, NATOPS Flight Manual NWO1-230 HLB-1 for the UH-34D calls for green and yellow arcs vice white.

The problem is, which do you believe? One wonders if the NATOPS people have the word. Possibly more aircraft models are involved in this situation.

V. S TWEET, AEC
NAS, DALLAS

▶ A review of other helicopter NATOPS Manuals reveals a large number are in disagreement with the AIB establishing the use of other color combinations for instrument marking. Consequently, NASC has recommended to BuWeps that the method of instrument range markings be standardized in all helicopters by instituting changes in the appropriate NATOPS manuals in accordance with AIB-5-54A or some other established system of marking. Further word on this subject will be published as developments take place.

Very resp'y,

Headmouse

Unlike the flight control systems on present day high performance aircraft—the Naval Aviation Safety Center desires a continued feedback.

Has information in any Safety Center publication ever helped you to prevent an accident, avert an injury, or deal with an emergency in a better way?

If so, and you have not already informed the Safety Center, it is particularly desired and important that you do so. Such feedback is vital to all departments at the Center and for fiscal support of our safety research and education program.

F-8 Nosewheel Control

Dear Headmouse:

The long nose and relatively large sail area of the F-8 serve to put a substantial twisting movement on the main landing gear when the aircraft is spotted on the angle deck during normal CVA launches.

While standing pri-fly observer watches I have seen F-8s with cocked nosewheels work their way almost completely out of the chocks. Besides the obvious danger of going over the side, it would seem that sort of working is not exactly beneficial to the landing gear.

I recommended that we always spot with the nosewheel centered. It has since occurred to me that it might be more effective to align the nosewheel with the axial deck and chock it, thereby easing the load on the scissors as well as providing more reliable restriction to lateral movement of the nose. It might be worth a try.

QUEECQUEG

▶ This problem has existed since the F-8 was sent aboard ship and has also affected other model aircraft. The F-8's sail area becomes even larger with wings folded and these factors must be considered by the flight deck director each time he moves the aircraft.

The problem is further complicated by slick spots created by fuel, oil, grease and engine exhaust residue . . . which are common in the angle deck area around the catapults and in the arresting gear.

Because the landing gear struts work continually aboard ship due to wind, roll, pitch, heave . . . these are designed to withstand the relatively minor stress.

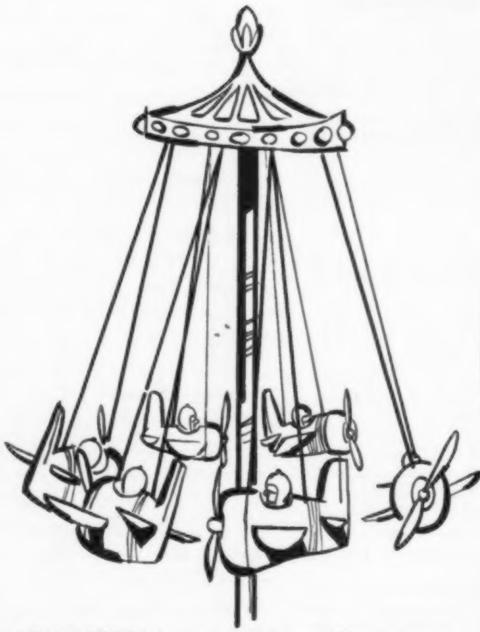
Standard shipboard operation procedures should prevent an aircraft from working its way out of the chocks—tiedowns should not be removed until the aircraft is ready to be moved into the launch spot and the chocks placed tight against the tires. The solution seems to be one of better control of, or reducing slick area potential. If the nosewheel is on a slick spot, it will slide regardless of how the nosewheel is aligned.

Very resp'y,

Headmouse

B.C. by johnny hart

ATC De



AIR TRAFFIC: A concentration of numerous aircraft over a given point, each demanding the same route and altitude and each having a special priority.

AIR TRAFFIC CLEARANCE: A verbal method o
snarling the foregoing traffic.

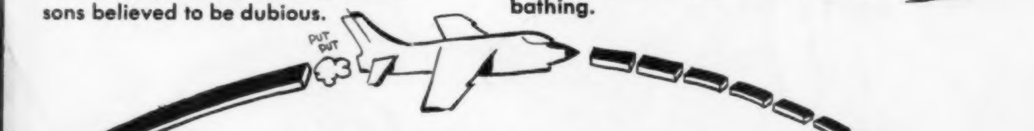
FLIGHT PLAN: Piece of paper that arrives in the center 30 minutes after aircraft concerned has checked over last radio fix.

BASIC VFR MINIMUMS: Those meterological conditio
under which a chicken can clear a low fence whi
maintaining satisfactory visibility.

initions

COMMUNICATIONS CENTER: Drafty illkept, barnlike structure in which people congregate for reasons believed to be dubious.

CONTROL TOWER: Ornate glass cage exceptionally good for sunbathing.

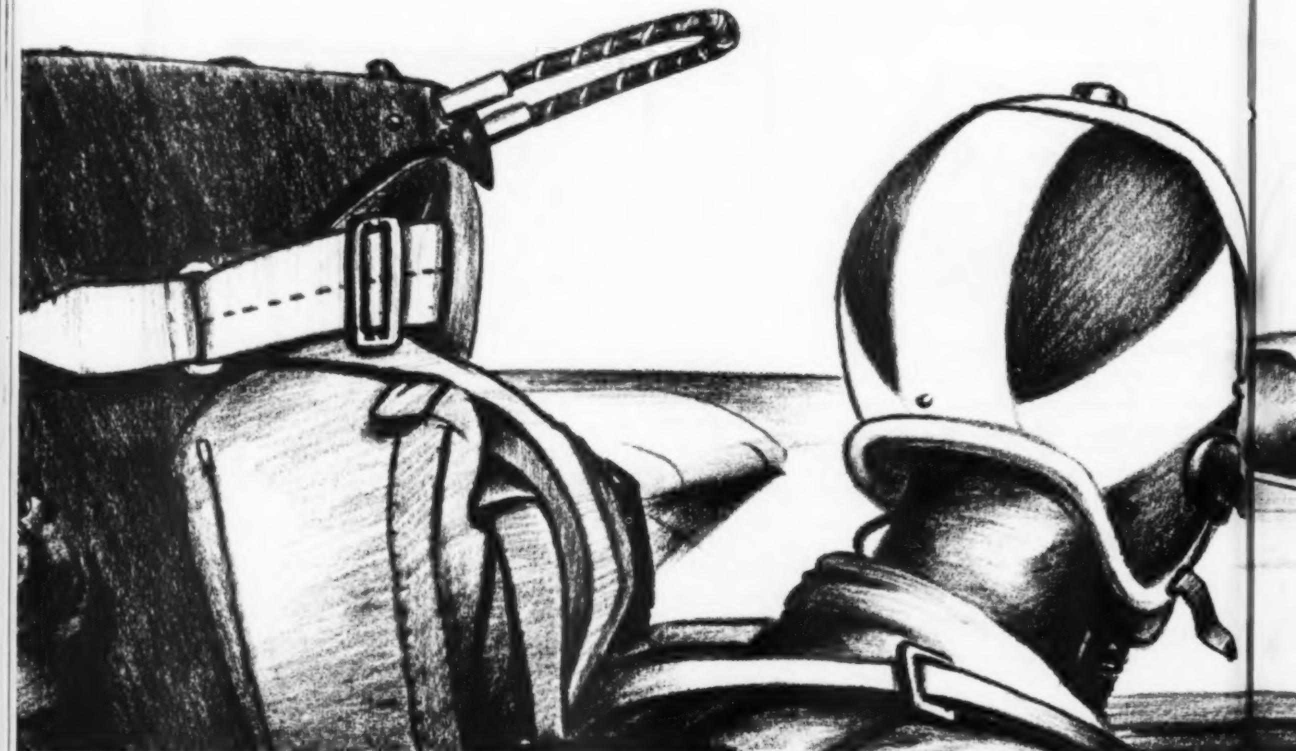


ALTERNATE AIRPORT: The last item of a flight plan. The airport toward which no aircraft has sufficient fuel to proceed to.

IFR: Conditions under which colliding 'Birds' do not know for sure what they hit in flight!

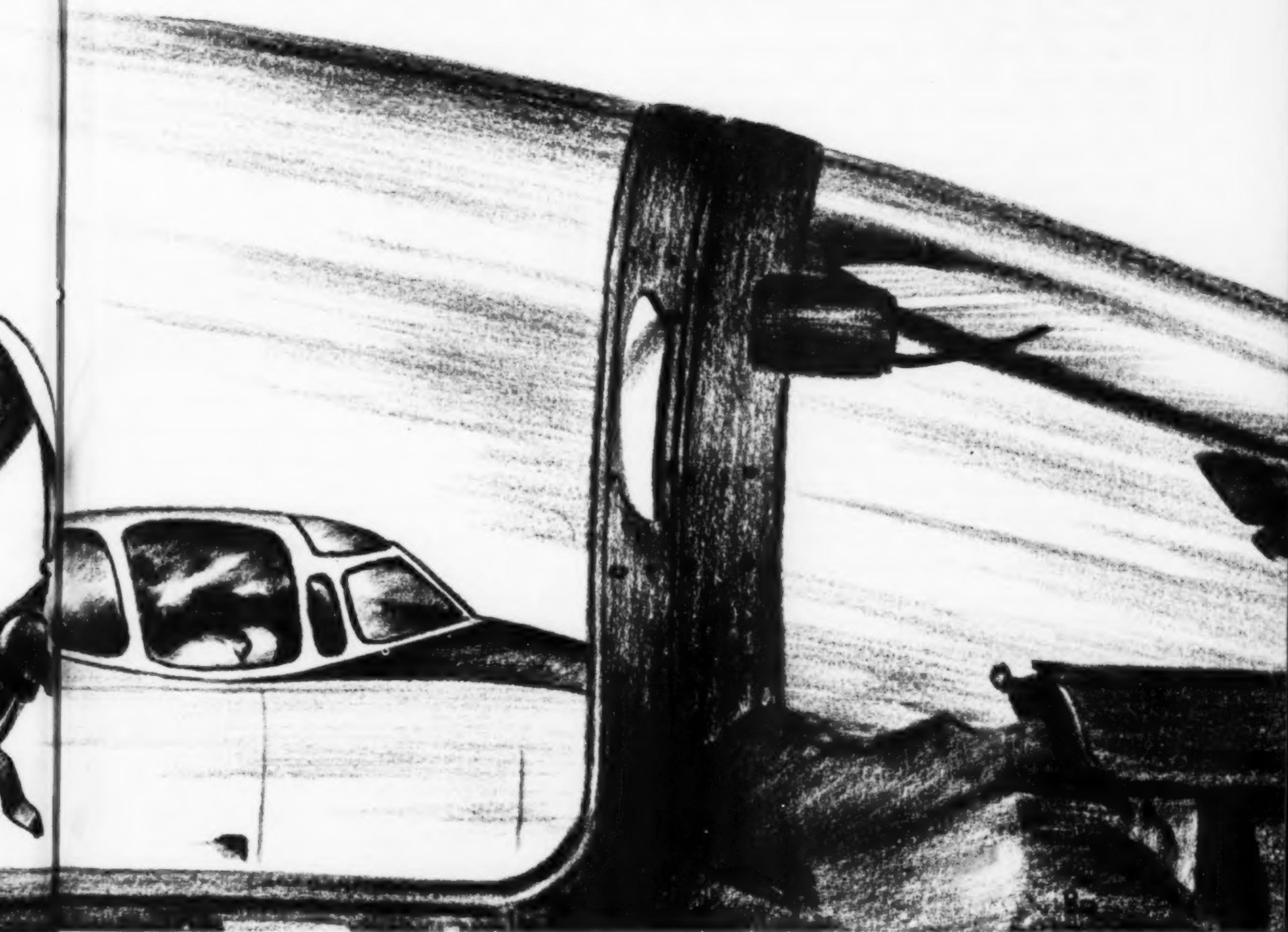
SEPARATION: That condition which is achieved when two or more aircraft fail to collide.

Pilot and photo technician were found in the wreckage of an RA-3B. Both men had died of hypoxia prior to the crash . . . ironically, investigators found the crew section of the cockpit area in "remarkably excellent condition." The victims' crash injuries were only small cuts and bruises. The accident which never should have happened in the first place was considered survivable but the airman's insidious enemy—hypoxia—had won this round in man's battle to survive at altitude.



The Cougar pilot observed that the person in the right seat was slumped and apparently unconscious.

THE INSIDIOUS ENEMY



On a day IFR flight in midsummer, an RA-3B departed NAS Southville for Northeast AFB. An intermediate passenger stop was scheduled to drop off the photo-navigator to attend a survival school. Pilot, photo-navigator and photo technician comprised the crew. At the passenger stop, the photo-navigator departed the aircraft and the photo technician moved into his position. This was temporary since another photo-navigator was to be picked up later at the destination to return with them to home base.

After dropping the original photo-navigator passenger, the aircraft took off at 1932Z. At 1935, the pilot made initial contact with the Air Route Traffic Control Center. The Center cleared him to destination on a preassigned frequency of 279.6 mcs. Clearance was acknowledged and the pilot gave his altitude as passing 22,000 feet. The pilot asked the Center to repeat a transmission at 1937:30, then to "wait one." Between 1944 and 1947, five calls by the Center produced no reply.

At 1949, the pilot replied negative when the Center asked if he was in any difficulty. To a query on altitude he reported he was level at flight level 310. At this time, he was assigned a new frequency, 263.1. He acknowledged 263.1. The Center tried

contact several times, requesting him to "squawk ident" on his transponder on the new frequency but there was no response.

At 1953, the Center's radar showed the aircraft making figure eight patterns. With communications still lost with the RA-3B, a Flight Service Station was instructed to attempt contact.

At 1955 the pilot was contacted by a second Flight Service Station on 272.7 mcs when he was heard attempting to contact the Center on this frequency. He informed the Station that he was on J-32 at flight level 310 and was not sure of his position. The Station lost radio contact with him at this time. The Center regained radio contact with him a minute later on his assigned frequency.

Communications were maintained between the Center and the aircraft for the next 18 minutes. During this time, positive radar identification was effected and a radar steer given the pilot. He reported navigational lock-on at 2005 and was resuming his own navigation. The Center acknowledged and the pilot thanked the Center for their patience.

At 2014, the Center effected a radar handoff and notified the pilot, directing him to contact his new Center on 385.6 mcs. The pilot was extremely confused and was unable to read back the frequency. This was his final transmission. The Center repeated its instructions. There was no reply. . . .

At 2021 the aircraft made a wide sweeping left turn. At 2033 a TF-9J was diverted to attempt an intercept. The F-9 pilot found the RA-3B at flight level 410, still climbing. Upon reaching flight level 440, the RA-3B engines stopped emitting contrails indicating that both engines had flamed out. The aircraft then commenced a rapid left roll and went into a vertical dive at a tremendous rate of speed. At 15,000 feet the aircraft righted itself to relatively level flight with a steady descent of 2000 feet per minute. At 13,000 feet the *Cougar* pilot joined up on right wing and observed that the person in the right seat—the photo technician—was slumped and apparently unconscious. The RA-3B continued to descend and crashed in a small wooded area and on into a cornfield. . . .

Ironically, accident investigators reported that "the crew's section of the cockpit area remained in remarkably excellent condition and was considered to be survivable." The pilot and crewman received minor cuts and abrasions none of which could have caused fatal injury.

Medical examination indicated a high probability that the pilot and crewman had died prior to impact as a result of a prolonged state of hypoxia.

Aircraft touched down in a cornfield at a fairly flat attitude. The relatively intact cockpit indicated that the crash forces were survivable.

The pilot was found wearing his helmet with his oxygen mask dangling from the left retention fitting. The right seat crewmember's oxygen mask was on the floor of the cockpit in front of him. His helmet was behind the pilot's seat. Both men's oxygen hoses were routed through the channel of their torso harnesses and connected to the aircraft oxygen system. The converter still had lox remaining. The oxygen system switches for both the left and right front positions in this model aircraft are of a lock type. They were both in the off position.

The first leg of the flight was normal in all respects with two important exceptions. As reported by the photo-navigator, who got off at the passenger stop, *no crew member wore an oxygen mask and no inflight check lists were called out during the flight.* This plus minor difficulties reported on this leg of the flight suggest the possibility of a state of early hypoxia in the crew.

According to the pilot's regularly assigned photo-navigator, the pilot usually performed his inflight checks religiously. Investigators surmised that after takeoff from the passenger stop, the pilot had to divide his attention between his own duties and those of his right seat crewmember. (This crewmember was not qualified to occupy the right seat on a minimum crew flight.) The pilot's knee board navigation log contained no inflight notations.

Review of the tape recording of the communications with the aircraft and various control agencies showed that the pilot reported a mixup in the cockpit shortly after takeoff. Further difficulties are evidenced early in the flight by the lack of response by the pilot and his improper radio communications. Investigators observed that the pilot's manner of speaking seemed to change, especially during the longer radio transmissions. Speech slowed and there was a slurring of words.

The pilot was possibly exposed to a reduced cabin pressure for at least 37 minutes. This elapsed period of time indicates that either there was partial pressurization of the cabin to 15,000-18,000 feet or the pilot was using his oxygen system intermittently. The pilot had more than 1500 hours of jet time and had completed low pressure oxygen chamber training 11 months before the accident. The aircraft accident investigation board thought it was highly improbable that a pilot with his experience in jet aircraft would remove his oxygen mask *if he were aware of a cabin altitude above 10,000 feet.*

An extensive independent accident investigation by the Naval Aviation Safety Center failed to disclose evidence of the malfunction or failure of the cabin pressurization/air conditioning equipment. Preimpact condition of the ducting connectors could not be determined.

The aircraft accident board thought that the climb to 44,000 feet observed by the intercepting pilot was caused by the autopilot. This climb, they surmised, further increased the cabin altitude to such a degree that the deaths of both crewmen from hypoxia resulted.

The most probable cause of the accident was failure of the crew to use system oxygen as required by the current NATOPS. (*At this writing oxygen masks are being worn from takeoff to landing by all crew members pending the publication of a special NATOPS for the RA-3B, EA-3B and TA-3B. This special NATOPS will modify the oxygen mask requirement for these aircraft.—Ed.*) The loss of cabin pressurization was only partial as indicated by the pilot's last radio transmission which was 43 minutes after takeoff.

ONSET OF SYMPTOMS AND DECREMENT IN PERFORMANCE FROM HYPOXIA*

Charles I. Barron, M.D., University of Southern California
(Naval Aviation Safety Officer Course—Outline of Aviation Physiology)

0 - 5000 feet—ideal: asymptomatic

5000 - 8000 feet—no symptoms in resting, healthy person except for decreased night vision.

8000 - 10,000 feet—long flights—fatigue, insomnia, weakness, irritability (transport aircraft)

10,000 - 15,000 feet—progressive cerebral deterioration frequently with insidious onset; headaches; visual changes; defective judgment; poor discrimination; slowing of reaction time; exhilaration.

- Insidious onset with decrements in cerebral function.
- Unreliability of verbal oxygen check.
- Rarely unconsciousness.

*These figures are ideal (pressure chamber), represent average and may vary from day to day and hour to hour. Physical activity lowers times by 50 percent or more (increased body needs for oxygen). Rapid or explosive decompression lowers consciousness time by 33 to 50 percent.

15,000 - 20,000 feet—extension of above with weakness, cyanosis (bluish discoloration) of nails; tremors of hands, fingers and head; loss of useful consciousness (10-20 minutes) and death (1-4 hours). Avoid dependency on cyanosis as a warning signal. Tremors are sign of severe hypoxia.

22,000 - 25,000 feet—loss of useful consciousness in 4-7 minutes

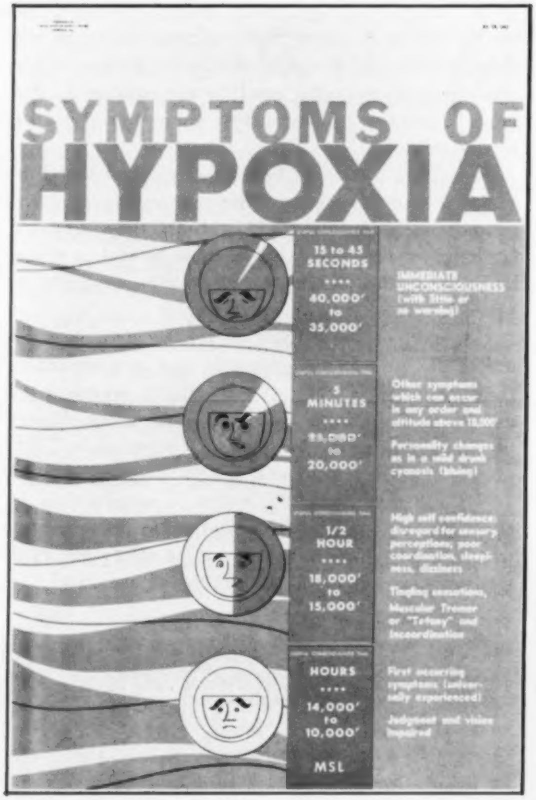
25,000-30,000 feet—loss of useful consciousness in 1-4 minutes (death in 8-10 minutes)

30,000-40,000 feet—loss of useful consciousness in 30-60 seconds and death in 2-5 minutes. May have no subjective symptoms of hypoxia (sudden unconsciousness). Recognition of pressure failure immediate and critical in this zone.

40,000 - 50,000 feet—loss of useful consciousness 15 seconds.

Above 50,000 feet—loss of useful consciousness: 10-15 seconds (circulation time from lungs to brain). Death will not occur in less than 90 seconds.

At 100,000 feet—death in a few seconds



During the five-year period from 1 July 1958 to 30 June 1963, there were 12 Navy fatalities in which hypoxia was suspected or proven.

Hypoxia, the airman's insidious enemy, is a threat which cannot be disregarded. To survive at altitude, man *must* take his "earth atmosphere" with him.

Oxygen enters the bloodstream through the lungs because it is forced there by a process called "oxygen partial pressure." Generally speaking, this presents no problem on the ground. At altitude it is another story. There the air is less dense and pressure is not great enough to force sufficient oxygen into the bloodstream to keep things normal. This lack of oxygen, or hypoxia, causes unconsciousness and eventually death.

Why didn't the two men in this accident realize that they were becoming hypoxic? Because of the effects of hypoxia on the higher brain centers, it is hard for a person to recognize that he, himself, is hypoxic. To further complicate things, different people react to hypoxia in different ways and *the same person doesn't always react in the same way.*

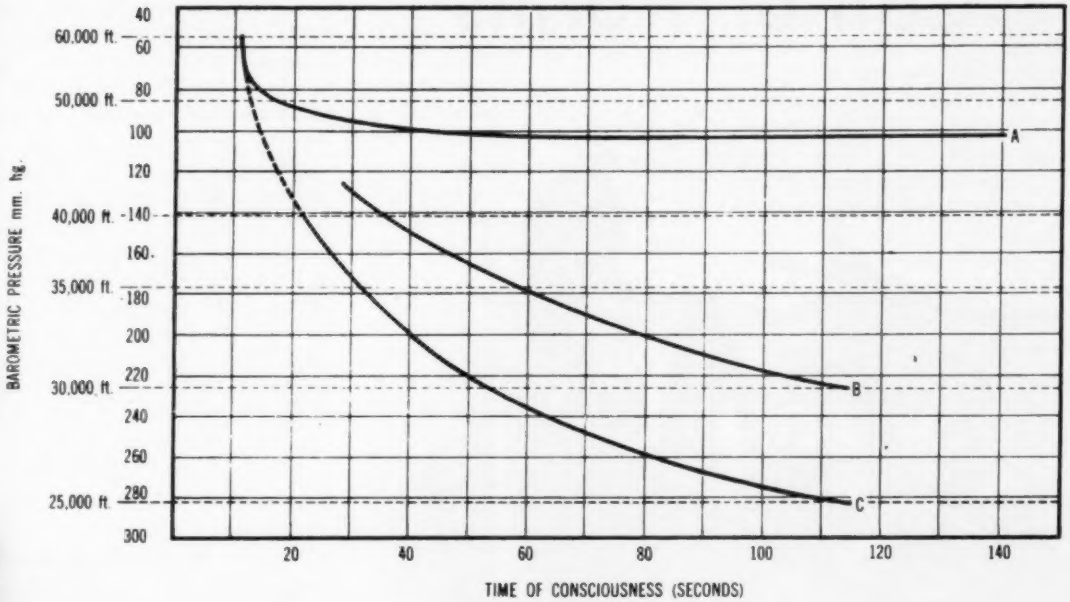
Generally, hypoxia in the early states can cause sleepiness, fatigue, headache, irritability, blurred vision, confused judgement and loss of muscular control. Sometimes hypoxia causes dizziness or nausea, giddiness or even a feeling of extreme well-being which has been compared to a mild drunk. *Occasionally, there are no subjective symptoms up to the time of unconsciousness.*

In the case of the RA-3B pilot, controller personnel recognized the symptoms of hypoxia at some time during the flight. The erratic flight path, the pilot's confused radio communications and the Center's difficulty in obtaining correct transponder response were all factors leading to the controller's awareness of the pilot's hypoxic condition. The con-

troller asked the pilot if he was "having any difficulty," but the inquiry was inadequate considering the feeling of well-being present in people who are hypoxic.*

In passing, we might mention the fact that smoking increases the possibility of hypoxia. The increased carbon monoxide content of the smoker's blood "takes up room" by combining with hemo-

*Navy controllers might do well to consider what they could do when they suspect a pilot has hypoxia. For instance, the controller could repeatedly and emphatically request the pilot to "check your oxygen and turn it on" or he could direct a descent to a lower altitude.—Ed.



A. BENZINGER - 100% Oxygen at ambient pressure (rapid decompression from 40,000 ft.)

B. HALL - Air breathing (mask removal at altitude)

C. WILSON and COMFORT - Air breathing (rapid decompression from 10,000 ft.)

Time of Consciousness with Varying Types of Exposure at High Altitude

globin normally used to transport oxygen. The eye and the brain are more sensitive to oxygen lack than any other parts of the body. This is why smoking decreases visual acuity at night.

Primary factors in hypoxia prevention are the maintaining of oxygen mask, regulator and aircraft system in good working order. But little good they will do, if as in this accident, they are not used.

Because of a number of circumstances, the most remarkable being the intact cockpit area in the wreckage, this is one of the most completely documented fatal cases of probable pilot and crew hypoxia on Navy record. In order that something of value may come from the unnecessary deaths of these men, take a hard look at your oxygen practices and procedures. Perhaps in the unaccountable accounting of things, these two men's deaths will save your life.

(Ed's Note: For another feature article on hypoxia, see APPROACH, *June 1962, "Mary Had a Little Lamp," pages 1-9.)*

"The biggest problem in the world could have been solved when it was small. . . ."

—Anon

Can of Worms

WHEN a UH-34D ditched and sank after coming in for a landing aboard ship, the survivors lost *three out of five* life vests.

The copilot had secured the buckles of his Mk-2 vest but, as was his custom for comfort, he did not snap the two fasteners. He lost his vest during egress but did not discover the loss until he reached for the inflation toggles. The ship's motor whaleboat was in the water at the time of the accident. The crew threw him a life ring and pulled him aboard.

After the aircraft sank, the copilot's vest rose to the surface of the water. A passenger who had also lost his vest during escape retrieved and inflated it. It kept him afloat until he was picked up by the whaleboat.

How did *he* lose *his* vest? During the flight he had held it in his lap. In his haste to escape the sinking aircraft, he left it behind. Incidentally, he had thought the floating vest was his until later, aboard ship, he read the copilot's name stencilled on it.

A second passenger had trouble unfastening his lap belt after the crash. Apparently in the process he opened the buckle on his life preserver (a Mk-3C). He, too, swam to a life ring and was rescued by the whaleboat crew.

"There is a need for constant reminders about the correct way to wear and to use safety and survival gear (as well as how not to wear and use it)," the investigating flight surgeon stated. "It must be remembered that not only pilots but crewmembers as well as passengers should be indoctrinated in proper techniques of wear and use before each hop if necessary."

This is the pilot's responsibility.

Watch That Step!

AS the survivor of a UH-34D water crash was hoisted by the rescue helo, the back of his head struck one of the steps—partly on his helmet and partly on the back of his neck.

"It is my opinion," he later stated, "that if I had not still been wearing my APH-6 helmet during the recovery, I would have received more than just a stiff neck when I hit those steps!"

Drugs

INSTANCES have occurred where pilots have undergone dental surgery and have been given various drugs without being grounded. All pilots should be reminded to notify their squadron flight surgeons in such cases for determination on whether the

notes from your flight surgeon

drugs dispensed would have an adverse effect on their flying ability.—*Safety Council Minutes.*

No Swimming

FROM an MOR: "Although not directly concerned with this accident, the survival training area was investigated concerning this pilot and his squadron. Survival training is essentially limited to lectures. These VF squadrons do not conduct Dilbert Dunker refresher, swim tests, helicopter hoist, parachute drag or life raft manning. This particular pilot had not completed a thorough water survival training syllabus since preflight in 1953. The close proximity of lakes as a possible ditching area demonstrates a need for more practical water survival training—not to mention fleet requirements.

There is no local instruction on Aviation Physiology and Land/Water Survival Training Program, the investigating flight surgeon points out.

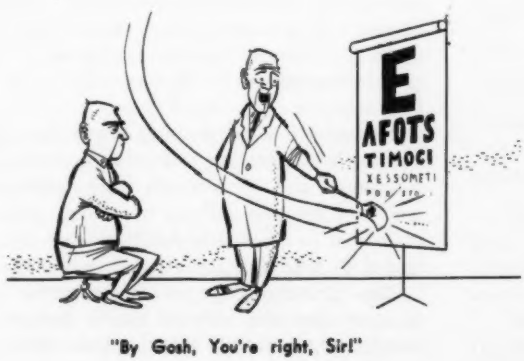
"Recently some ASW squadrons have been requiring swim tests for aircrewmen—being optional for pilots," he states. "VF and VR squadrons do not participate. . . . Passing grades are entered into the aircrewman's qualification card but no strict follow-up on failures is conducted."

OpNav Instr 1510.4D of 28 Apr 62, Qualification for Aircrewman, states "All aircrewmen must qualify/requalify in the following general requirements: . . . Demonstrate the ability to use correctly all survival equipment of type aircraft to which assigned. Demonstrate a proficiency both in land and water survival techniques and satisfactorily complete a training syllabus and flight check.

OpNav Instr 3740.3B, 25 Feb 59, Aviation Physiology Training/Indoctrination, calls for training under appropriate conditions in flotation gear, Dilbert Dunker, ditching procedures, survival equipment, etc.

Loses Helmet

A CH-19E pilot did not have his helmet chin strap fastened. During violent, uncontrolled maneuvers preceding the crash, the helmet came off. His head struck the map case resulting in minor contusions.



"By Gosh, You're right, Sir!"

Smoking Hazard

DURING climbout the B-47 aircraft commander lit a cigarette. Oxygen setting was 100 percent, emergency ON. No problems were encountered until he leaned forward, bringing the lighted cigarette into the stream of oxygen. The cigarette flared, the paper flamed and immediately thereafter the oxygen mask became a torch with the flame occurring just outside the mask. In order to remove the mask the pilot had to hold it with one hand while removing the chin strap with the other. He pulled off both the mask and his helmet and clamped the hose about halfway in order to shut off the flow of oxygen. Only after he had done this was he able to turn off the regulator. All flame subsided after the oxygen supply was cut off. The aircraft commander received second degree burns on the thumb and right wrist and first degree burns on the left wrist and right index finger.—*Aerospace Safety.*

Visors Down

BECAUSE both men in an S-2 accident had their visors down, they received no injury to face or eyes. They described the cockpit as being filled with dust, dirt and chips—all probably fragments of the runway entering through the nose wheel bay or the shattered radome. If they had been blinded temporarily by an injury to face or eyes, egress from the aircraft would have been much more difficult.

Recommendation: Visors on APH-5 and APH-6 helmets be lowered during all landings whenever permitted by visibility, particularly since the hatches are open. —*Flight Surgeon in MOR*

Our way or one way of life is to profit by mistakes of others; consequently since we won't live long enough to make them all ourselves any referral to an aircraft accident is not coincidental. Here a maintenance officer reviews and comments upon a maintenance caused aircraft accident.

WHERE THE BUCK STOPS

By LCDR M. H. Krouse
Staff ComFAirAlameda

This accident is a pure example of the three major deficiencies existing in the Naval Aviation Maintenance Program.

These major deficiencies are categorized into three areas and have remained relatively unimproved for the past two years. The areas concerned are:

Supervision.

Motivation and Workmanship.

Quality Control.

A review of a recent accident report significantly pinpoints all factors into one or more of the above areas. Specifically these factors are associated to the areas as indicated below:

Supervision

Apparently procedures have become so stereotyped that personnel from the squadron, supporting Aircraft Maintenance Department and even the Accident Board failed to review and properly utilize appropriate maintenance directives to determine the manufacturers' source code. The removed and replaced part is properly coded MO and should have been ordered through the supply system in accordance with existing directives rather than manufactured "as per sample" by the supporting Aircraft Maintenance Department. Failure to uncover this mismanagement can rightfully be additionally associated to the area of Motivation and Workmanship, and Quality Control.

Initiative is a great thing. Even though on the surface the operation looks simple enough, critical tolerances and adjustments were destroyed. Failure to refer and adhere to proper manuals can only lead to more complex problems and, as illustrated in this case, an aircraft accident.

The primary duty of senior petty officers is to supervise and instruct rather than to become totally engrossed in actual production. Lack of

this supervisory function was evidenced by the improper removal, manufacturing, installation, and reassignment of personnel throughout the process. Supervisory personnel failed to give consideration to the assigned men's experience, training, and ability. The men assigned to the job were deficient in experience, ability, or training, possibly all three. Supervisory assistance was not provided during installation.

Motivation and Workmanship

The standards of command are reflected in this area. Command must accept this direct responsibility and through the use of experience, training, and provisioning of facilities constantly strive to improve motivation and workmanship.

Possibly it can be considered that the tempo of operational pressures and subsequent overcommitment of aircraft induced the evidenced lack of motivation and poor workmanship.

The quality and standard of Commands' efforts to provide motivation and improve workmanship contribute directly to the mechanics' mental attitude. In this accident, the mechanics' mental and physical condition become factors of motivation and workmanship, and sometime during the installation process were contributory to inferior performance of aircraft maintenance. An alert awareness and understanding that lack of consideration for motivation and workmanship can lead to error should have triggered cognizant production supervisory personnel and subsequently Quality Control personnel to more rigid attention to their management of personnel assignment responsibilities.

Quality Control

The tasks assigned by Quality Control must perform and satisfy the functions listed in Chapter 7 of BuWepsInst 4700.2. In this accident the task of acceptance inspection was not accomplished properly. The details, policies, and procedures of the task of acceptance inspection must be of such design to begin at the earliest point possible in the work process. Continuation of the inspection task must continue throughout the evolution by collateral duty inspectors.

Failure by Quality Control to note the obvious improper performance of aircraft maintenance work was contributory to the accident. This indicates lack of effective inspection procedures while maintenance work is in progress and after it is accomplished. Quality maintenance is elusive. The attitude that "someone else will catch it" apparently exists in the squadron. The obvious lack of quality maintenance in this accident supports the analysis and conclusions of the Navy-wide review of maintenance caused accidents for the fiscal year. Neither the number nor type of malfunctions is a positive measure of the success or failure of maintenance performed.

Areas where quality maintenance can be measured accurately are uncorrected discrepancies and inadequacy of corrective action taken. In this case the procedures of Quality Control have allowed inadequate corrective action. This points to management's failure to supervise and instruct. Evidently the maintenance officer is accepting this kind of work or is unaware of its existence. The squadron commander is affected since his is the responsibility for quality maintenance. The commanding officer through the maintenance officer sets the standards for maintenance practices, and has in quality control the eyes and ears to tell him at what level that quality is.

The key men in maintenance error prevention are those who possess the priceless combination of training and experience necessary to translate ideas into action. So, as all roads lead to Rome in the final analysis, it becomes the "Skipper's Burden."

Maintenance Goofs Down

COSTS UP

Maintenance Errors by Rate and by Aircraft

Rate / Aircraft	AD	AM	AT	AE	AO	P/C	Other	Total by Aircraft
A-1	1				1			2
A-3	1	2						3
A-4	2	3	1		7	4	2	19
A-5		2						2
A-6	1	1					1	3
F-1	1							1
F-4	2	2						4
F-8	2	5		2	3		3	15
F-9	1	4						5
F-10	1				1	1		3
T-1		1						1
T-2		1				1		2
T-28	1							1
H-2	1							1
H-3A						1		1
H-34	2							2
P-2	1	3		1	1	1		7
P-3A	2	1		1			1	5
S-2A	3	2		1		1		7
C-45	1							1
C-117		1						1
C-119							1	1
C-1					1			1
C-121	4	2						6
C-131	1	1						2
E-2A							1	1
Total by Rate	28	31	1	5	14	9	9	97

A 10 percent reduction in the number of reported maintenance errors was realized during fiscal '64. This is *the first substantial gain during the past four years*.

In view of decreasing experience level of maintenance people and increasing complexity of aircraft during these years, this can be considered a major achievement by all concerned with naval aircraft maintenance.

This breakthrough can be attributed to a number of factors but high on the list are the acceptance and development of effective quality control, and reporting and publicizing of maintenance errors so that others can profit by these mistakes.

Statistically speaking, here are the figures:

Average number of errors during fiscal '61, '62, '63	351
Total for '64	316
Net reduction	35

Dollar costs of aircraft are up. Consequently, dollar losses are up in spite of fewer errors. Dollar losses for '62 and '63 averaged $18,750,000. Losses during '64 amounted to $18,857,000—an increase of $107,000. The story here is somewhat like climbing a ladder one step and slipping down two. This trend is a continuing one so the importance of reducing the number of maintenance errors deserves the full attention of every man maintaining an airplane. The only way we're going to beat the game of *cost effectiveness* is to beat down the number of maintenance errors.

Now let's take a look at some of the errors causing the total loss of a trainer, chopper, fighter and one of our newest reconnaissance aircraft.

Improperly secured cowling caused the crash land-

ing of a T-28; an unconnected flight control surface input rod caused a UH-2A to crash on takeoff; failure to replace a high time bleed air valve which was faulty caused an F-8 flameout; and the loss of hydraulic fluid in both of its flight control systems due to cross-connected (Murphy's Law) fluid lines caused the crew to eject from an RA-5C—a five million dollar loss!

The following damage and personnel injury were the result of maintenance and personnel errors.

Aircraft Damage		**4th Qtr**	**3rd Qtr**
Strike	A	4	6
Overhaul	B	2	3
Substantial	C	4	5
Minor	D	13	13
Limited	E	34	47
Estimated Loss		$8,946,210	$3,617,960

Personnel Injuries—B		4th Qtr	3rd Qtr
Fatal	A	1	0
Critical	B	0	0
Serious	C	0	0
Severe	D	1	2
Moderate	E	0	1
Aircraft Accidents			
Total Maintenance Errors		96	125

"AD"

A-1 Failure to properly secure cowling assembly. D damage.

A-3 Improperly torqued the air sensing P&D valve line. Flight aborted.

A-4 Wrong size lug installed in a drop tank causing fuel leak and fire. D damage.

A-4 An external fuel tank was improperly installed and lost in flight. E damage.

A-6 A self-locking nut was reused and overtorqued. The main oil strainer stud broke, causing loss of oil pressure. Flight aborted.

F-1 An attempt to start the engine with the duct covers installed resulted in an engine fire. E damage.

F-4 Engine bleed air duct was damaged during engine installation. Cause—improper engine installation technique.

F-4 An undertorqued B-nut on the oil scavenge tube caused a generator failure.

F-8 Improperly torqued bolts on the fuel manifold distributor caused an inflight fire and D damage to the aircraft.

F-8 The main fuel transfer pump elbow was cross-threaded causing an inflight fire and explosion. C damage.

F-9 The high pressure fuel hose assembly was damaged during installation of the tail section. The engine flamed out on landing.

F-10 Starboard external fuel tank separated from the aircraft inflight due to improper loading procedures.

T-28 Lower right-hand engine cowl panel was not properly secured. It came off in flight. The aircraft stalled and crashed during the landing attempt. A damage.

UH-2A Improperly installed azimuth control rods caused A damage and A injury.

UH-34 Improper installation of a screw in the servo unit by an unsupervised unqualified man caused D damage.

UH-34D Improperly timed magneto and improperly adjusted spark plugs caused F damage.

SP-2H Overtorqued water injection nozzles caused F damage.

P-3A Improperly adjusted propeller control caused propeller pitch to lock. F damage.

P-3A Undertorqued pitch regulator caused pitch lock, low pressure warning light and failure to unfeather. F damage.

S-2A Improperly installed propeller governor hose caused inflight securing of the engine. F damage.

TS-2A Improperly installed rocker box drain tube caused inflight securing of the engine. F damage.

S-2E Vapor vent not secured by maintenance personnel, caused fire, F damage.

TC-45J Failure to fill oil tanks after draining oil caused F damage.

EC-121K Improperly torqued throttle eye bolt caused inflight securing of the engine. F damage.

EC-121P Failure to lockwire oil plug caused in flight loss of oil. F damage.

EC-121K Failure to lockwire gland nut on rocker box caused oil leak; flight aborted. F damage.

EC-121K Improper installation of the interconnector oil drain to no. 7 cylinder caused F damage.

C-131 Carburetor attachment bolt left in blower section caused aborted takeoff. F damage.

"AM"

A-3 The wrong track assembly was installed on the flap. E damage.

A-3 The wrong hinge was installed on the main landing gear door—door came off in flight. D damage.

A-4 Due to an improperly serviced strut the port main landing gear failed on CV landing. C damage.

A-4 A cabin pressure regulator which was not properly lock-wired caused canopy damage to overpressuring cockpit. E damage.

A-4 Improper jacking of the aircraft resulted in a hole punched through the starboard wing. D damage.

A-5 The air storage tank was overpressurized by servicing personnel and it exploded causing 450 manhours of work. D damage.

A-5 Murphy's Law—Cross-connecting the Side Looking Radar hydraulic system to the adjoining dust cap stowage bracket caused loss of no. 2 hydraulic system. Loss of a torque limiting venturi set screw caused loss of no. 1 hydraulic system and complete loss of flight controls. Crew ejected. A damage.

A-6 A B-nut left loose on the ram air turbine outlet pressure line caused B damage during an attempted morest landing.

F-4 Utility hydraulic reservoir nuts overtorqued, the reservoir failed. The aircraft received B damage during an attempted morest landing.

F-4 Overservicing the starboard main landing gear strut (800 psi vice 113 psi) caused the shrink link to fail. E damage.

F-8 Because the utility reservoir overboard vent line was capped off, the reservoir was overpressurized and burst. D damage.

F-8 An improperly installed canopy actuator safety pin allowed the canopy actuator to fall forward and fire. E damage.

F-8 The brake assembly was installed on the aircraft with bent bolts. Port brake locked on landing and the aircraft left the runway. B damage.

F-8 A piece of scrap metal lodged in the two-position wing control linkage caused the two-position wing to remain down. The aircraft was diverted to a shore base for landing.

F-8 Inboard leading edge droop was disconnected and left hanging down. No tag was placed in the cockpit, so the plane captain spread the wings damaging the droop. E damage.

F-9 Murphy's Law—Wingfold timer check valve was installed backward jamming the wing after about 1/3 travel. E damage.

F-9 Flaperons locked in flight due to a contaminated hydraulic filter. Bypassing fluid allowed metal particles to flow into the system.

F-9 A quick-disconnect air chuck was left on the nose landing gear strut schraeder valve and bound the nose gear in the up position. D damage.

F-9 A landing gear torque arm scissors was crossthreaded; no cotter pin installed. The scissors separated and the wheel rotated 90 degrees. E damage.

T-1 Nose landing gear collapsed because the check crew raised the landing gear handle and applied hydraulic pressure. No ground locks were installed. E damage.

T-2 Canopy lost in flight. It had been disconnected for a demonstration but not reconnected prior to flight. E damage.

SP-2H Jam nuts on escape hatch left loose. E damage.

SP-2H Failure to properly torque nut on life raft pulley caused F damage.

SP-2H Murphy's Law—The pulley connector was installed on the wrong side of pulley arm. F damage.

P-3A Aileron controls jammed due to improper installation of friction plate. F damage.

TS-2A Improperly installed escape hatch caused in flight loss. F damage.

TS-2A Murphy's Law—Rudder trimmer hydraulic lines cross-connected. F damage.

TC-117D Murphy's Law—Cross-connected hydraulic lines. E damage.

EC-121P Failure to install cotter pin caused flight abort. E damage.

C-121J A nut was left off the cabin supercharge disconnect linkage—unable to disconnect. F damage.

C-121 Nose landing gear was jacked with a check stand under the tail. E damage.

"AT"

A-4 Failure to fasten the radome caused its loss during flight.

P-3A Aircraft landed with radome stuck in down position; wrong type lubricant froze screwjack. F damage.

"AE"

F-8 The left-hand electronic access panel was not properly secured. It separated in flight damaging the vertical stabilizer. E damage.

F-8 Main fuel boost pump shorted and caused an inflight explosion due to an improperly installed grommet on the leads. C damage.

SP-2E Lock washer was left off terminal fitting. F damage.

P-3A Wrong type screw installed in generator assembly. F damage.

TS-2A The leading edge of the port wing flew up on takeoff, flight aborted. D damage.

OV-1 Actuated photo pod, Type LB-11A; ejector reset with cartridge installed caused D damage.

"AO"

A-1 Safety precautions were not observed and 20mm gun was fired on the ground.

A-4 An unauthorized bomb which was loaded on MRB station separated from the aircraft and punched a six-inch hole in the wing. D damage.

A-4 An improperly loaded practice bomb separated from the aircraft after takeoff.

A-4 The external fuel tank fell from the aircraft in flight. The Aero 20A rack was not properly latched.

A-4 Throttle jammed by labs cannon plugs left adrift.

A-4 An improperly secured feed mechanism separated from the aircraft in flight.

A-4 Installation of the cartridges in an Aero 2OA rack during the wiring check caused ejection of the external fuel tank. F injury.

A-4 An A/A37B-3 bomb rack was ejected on the first bombing run because the primary lead was not disconnected during installation.

F-8 An LAU-33 with two Zuni separated from the aircraft after a normal afterburner takeoff; the launcher was not properly locked.

F-8 Front mount gun retainer pin came loose—gun fired through the intake duct. E damage (2 cases).

F-10 An external fuel tank was improperly installed. It separated from the aircraft in flight.

Plane Captain

A-4 Rags left in the engine compartment caught fire during ground runup check for fuel leaks. C damage.

A-4 An improperly installed ground safety pin allowed the starboard main landing gear to fold while the nose gear was being drop-checked. E damage.

A-4 A fuel cell access door was lost in flight. It had not been secured by the fueling crew.

A-4 The lower fuselage access door was lost in flight due to improper installation. E damage.

F-10 Pilot's lower escape chute door was not fully latched; it was lost in flight.

T-2 Engine access doors opened and were damaged during touch-and-go landings. These had not been fully latched. E damage.

SH-3A Improper procedure to fold blade caused F damage.

SP-2H During maintenance the bomb-bay tank was released containing 200 gallons of fuel. F damage.

S-2A Failure to properly inspect brake pucks on preflight caused E damage.

Other

A-4 Murphy's Law—An A/A37B-3 practice bomb rack was ejected on the first bombing run. The primary and emergency electrical leads were reversed and improperly marked by the manufacturer.

A-4 Fuel servicing personnel disconnected the nozzle prior to shutting off the pump; fuel spilling into the engine duct caused a fire. The nozzle man suffered flash burns. E damage.

A-6 The canopy slipped off the winch hook which was two-blocked while hoisting; it fell damaging the fuselage and wing. E damage.

F-8 O & R personnel failed to change the engine bleed air valve resulting in pressurization loss, low fuel warning and engine flameout. A damage.

F-8 FOD damage to engine due to incomplete installation of a nose section access door. The door was sucked down the intake duct. E damage.

F-8 Two aircraft were damaged due to the actuation of the UHT without insuring proper clearance. E damage.

P-3A Internal wrenching cap screw was under specified hardness. F damage.

C-119F Failure to provide sufficient clearance between elevator and hangar door. E damage.

E-2A During wing spread an electrical power cart was hit. E damage.

ERROR OF OMISSION

By LT R. A. Howard

The night was dark and ominous. A ragged misty overcast hung low over the ship. The carrier's bow pitched lazily in search of a nonexistent horizon. The Lieutenant emerged from the red glow of flight deck control and as he walked aft to man his aircraft his eyes attempted to penetrate the darkness. A cold shiver ran down his spine.

"This is going to be a hairy one," he thought out loud.

The Lieutenant didn't know it, but this was to be his final flight. He would not return from this mission. His fate had already been sealed by a chain of events started the previous day of which he knew nothing and over which he had no control.

The incredible chain of events of which the Lieutenant was the final and innocent link began following the previous day's flight operations. One of the squadron pilots had flown the Lieutenant's aircraft that day and had experienced difficulty with engine operation. The engine had flamed out at 27,000 feet, but the pilot had obtained a relight in the manual fuel control system.

After returning to the carrier for an uneventful landing, the pilot discussed his problem with the maintenance crew. The trouble was diagnosed as a faulty fuel control unit. The decision was made to change the fuel control unit and the aircraft was put below to hangar bay three.

A work order was issued to the Aircraft Division to change the fuel control unit. The Power Plants Chief assigned the task of changing the fuel control to a well qualified first class petty officer and his helper, a third class with little experience. The crew was told to expedite as the aircraft was needed for the next day's operations.

The background had been set for the first error in the chain of events leading to the Lieutenant's last flight.

Morale of the maintenance crew of the squadron was very high. They had a genuine desire to maintain outstanding aircraft availability. The First Class was eager to get the job done and return the aircraft to flight status. Unfortunately for the Lieutenant, he was much too eager.

Work on the aircraft progressed smoothly into the night. However, progress was slow due to the darkness in hangar bay three. During the installation of the new fuel control, the First Class went below to eat midnight chow leaving the Third Class to continue the work. Although the crew leader did not expect it, the Third Class managed to complete the fuel control installation and connect the throttle linkage by himself.

The cotter pin securing the nut on the throttle linkage bolt was left out pending turnup and final adjustment of the fuel control unit and throttle stops. When the crew leader returned from chow he found the job finished and his charge awaiting his approval. He was pleased to find the work done and proceeded to inspect the fuel control. An hour later the aircraft was topside turning up. The throttle was now adjusted to the satisfaction of the crew leader so he shut down and secured the Third Class. During his final inspection in the poor light and in his own haste, he failed to notice the missing cotter pin. The omission leading to the accident was to go unnoticed.

The crew leader was aware that the aircraft must be test flown and that an inspection by a Quality Control Inspector was needed. It was late but he knew the Quality Control Chief was in the readyroom discussing another maintenance problem with the maintenance officer and other Q. C. inspectors. The crew leader went to the readyroom and informed the Q. C. Inspector that an inspection was needed before a test flight could be flown in the morning. The Quality Control Chief said that he would inspect the work performed just as soon as his conference was over.

Over an hour later, the Quality Control Chief left the readyroom and proceeded to hangar bay three. He was very tired from a hard day of aircraft operations and had little time for sleep before the next day's operations would begin. In his eagerness to get to bed he inspected the aircraft's fuel control system much faster than he usually did. In fact, his inspection was so fast that he failed to notice that the cotter pin was missing from the fuel control link-

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. . . busy, busy and tired . . .

. . . flew final flight . . .

age nut. Thus, the second error of omission leading to the Lieutenant's final flight was committed.

The aircraft was now placed in an "up" status and scheduled for a test flight on the first launch in the morning. The Maintenance Officer decided to perform the test flight himself since he considered himself the most qualified test pilot.

The following morning, the Maintenance Officer was briefed on the aircraft discrepancy and the work accomplished by the Quality Control Chief. He manned his aircraft on the flight deck and, accompanied by the plane captain, proceeded with the preflight inspection. During the preflight inspection he opened the fuel control access door and inspected the area that he knew was worked on. Neither the maintenance officer nor the plane captain noticed that the important cotter pin was missing on the throttle linkage. Two more errors of omission were added to the fatal list.

The test flight appeared to be completely successful to the maintenance officer. The aircraft performed to his satisfaction. Upon his return to the ship he placed the aircraft in an operational status and made it available for further flight. Little did he know that the lack of the missing cotter pin had allowed the nut on the throttle linkage to the fuel control unit to back off. It was only a matter of time before the system would fail. In fact, it would fail on the very next flight, the flight from which the Lieutenant would not return.

A pilot's life and a one-million-dollar aircraft were lost that dark night far out at sea because the people he depended upon failed to perform their jobs correctly. Each man in the chain of events leading up to the final sickening and useless loss committed an error of omission in his area of responsibility. The Lieutenant was the victim of human error over which he had no control and in an area where human error cannot be tolerated.

Let Me See It

EVER notice the reaction of a man being shown a hot item—like the promotion list, for instance? Chances are that after you've shown it to him—he looked—read—yet snatched it from your hand and said "Let me see it." What he meant is—let me feel it. He wanted to confirm with another of his senses that he did in fact *see* it. He wanted to be sure.

This brings us to the point we'd like to make. How often have you even after a second look decided to feel for a cotter pin to make sure it was in place? From experience we know that complex arrangements of push rods, links and bellcranks tend to blend together as one color. This situation coupled with eye-strain makes the possibility of overlooking the elusive cotter pin even greater.

As in the case of the promotion list, when it comes to checking cotter pin installations—make sure you "see" it—feel it!

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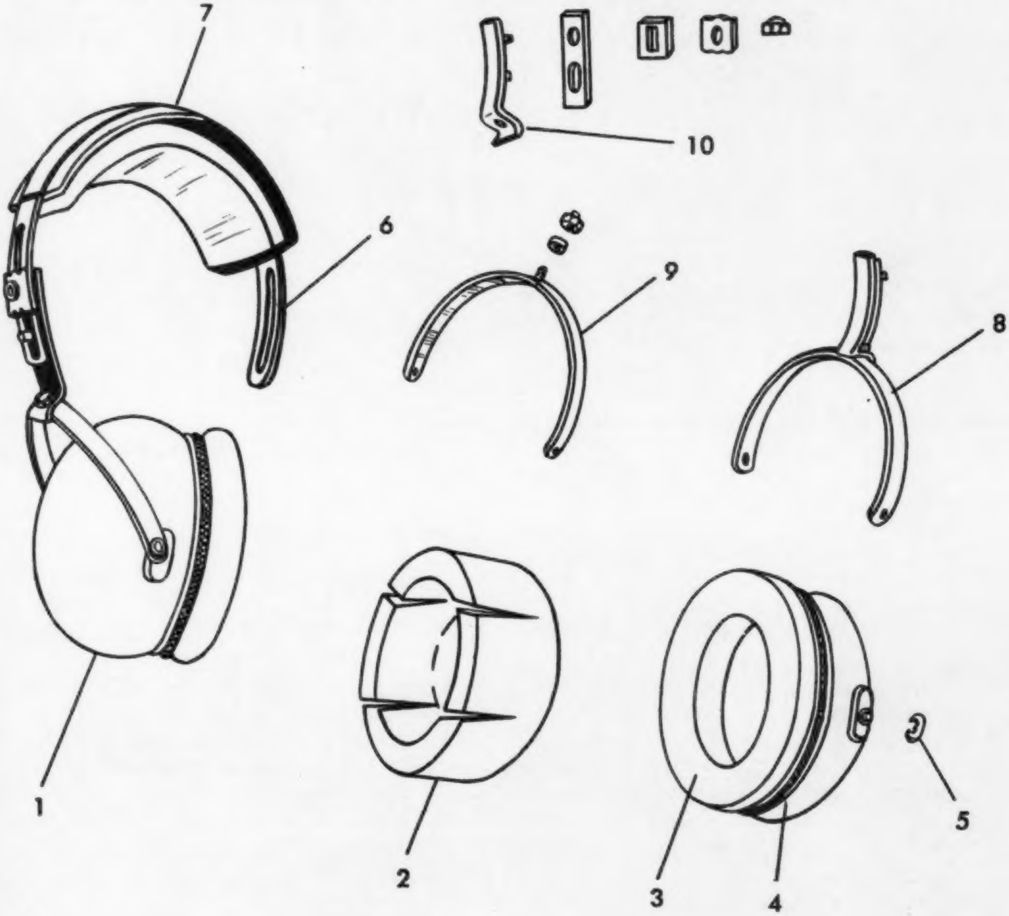
MICKEY MOUSE PARTS



NOW "hear" this! Parts are available to repair defective sound attenuators (Mickey Mouse) ear muffs. Don't jeopardize your hearing by wearing bad sets or not wearing them at all. Simply order the parts you need.

Here are the stock numbers of replacement parts, items 2 and 3 for David Clark Co. ear protector models 19A and 372-9AN/2, FSN RD 4240-856-6650-LF-50:

2. Filter Puff, RM 4240-674-5379-LF-50, PN SP 1660C

3. Seal, Plastic RM 4240-979-4040-LF-50, PN SP 2014

Other parts shown can be ordered by manufacturer's part number as listed:

1. ASP-184, Dome Assembly
4. SP-2061, Dome
5. SP-3B, Retaining Ring
6. ASP-137, Headband Assembly
7. ASP-160, Headpad Assembly
8. ASP-80, Stirrup Assembly
9. SP-6, Stirrup
10. SP-234, Stirrup Clamp
11. SP-1645, Headband

Fleet Support is a 'Two Way' Street

By LT F. H. "Chips" Cohan
AMD NAS NorVa

DEPENDING upon which side of the fence you are on, it always seems that they (the other fellows' outfit) are not cooperating and pulling a fair share of the load.

Many rumblings are heard to the effect "AMD is useless, Boy!—They sure hate to do anything—never have the equipment they obviously need—their maintenance is lousy—the men are not interested or qualified"—and so on and on.

This attitude is most apparent in the field of support equipment, so let's see why.

Seldom is the BuWeps Allowance list consulted as to the equipment rated, and this results in demands for equipment for which there is no allowance or provision.

In many cases, the Support Equipment Officer of the squadron or unit is a junior officer, relatively inexperienced, who has had no background in equipment problems or allowances.

Blind loyalty to his unit, plus the ingrained attitude that "my men can do no wrong" (as far as outsiders are concerned) and the pressure from his superiors results in confusion, and hard feelings. This generally detracts from the cooperative spirit so necessary for efficient operation.

Fortunately, there is still common sense to fall back on, and, regardless of allowances, where a need is clearly apparent and justifiable, all-out efforts are made by the AMD to procure and issue the equipment. In such cases, the squadron or unit concerned should follow up with a letter of justification to BuWeps requesting the allowance manual be changed accordingly.

An even greater problem is the user lack of interest in the care and use of the equipment once it has been issued to them. Examples of this are listed below:

Charg-a-plates are lost.

Keys broken or lost, and in some cases the entire switch is removed.

Batteries are lost or stolen.

Radiator and gas caps lost or stolen.

Hoods, covers, and doors damaged, lost or removed and left in hangar/shop.

Engine hours, jet starts, and equipment logs are not kept current.

Daily maintenance not performed resulting in severe, costly damage due to lack of oil, water, or correct fuel.

Starting cables damaged by improper stowage, dragging on the ground, or pulling away from aircraft without being disconnected.

Lights and horns stolen or damaged.

Equipment driven or towed with flat tires.

Equipment damaged by obvious accident or abuse is turned in with attempts made to cover up the damage, shield the culprit, or to avoid making out a report by denial of responsibility.

These abuses are daily occurrences recorded over a period of a year. Of course, they are from another outfit—not yours. But—are they? C.O.s with a sincere desire to know would do well to check both ends of the street.

All hands from Flag Officers through the lowest rated man must realize that there is not a Horn of Plenty in the guise of AMD, and replacement equipment is not always available. Cooperation and common sense are the keynotes to keep traffic flowing on the Two Way street and insure the highest usage possible. Do not abuse equipment, or allow it to be abused. Turn it in for immediate repair as damage occurs, or as part of a unit becomes inoperative. Individual repairs can be made rapidly—but cumulative discrepancies will require greater down time and possible loss of equipment, particularly when the accumulated repair costs become greater than the current value of the equipment. Use the Two Way street often to keep your equipment rolling, and use the sidewalks to exchange ideas and problems with the AMD to improve attitude, availability, and economy. Remember, it has to remain a Two Way street.

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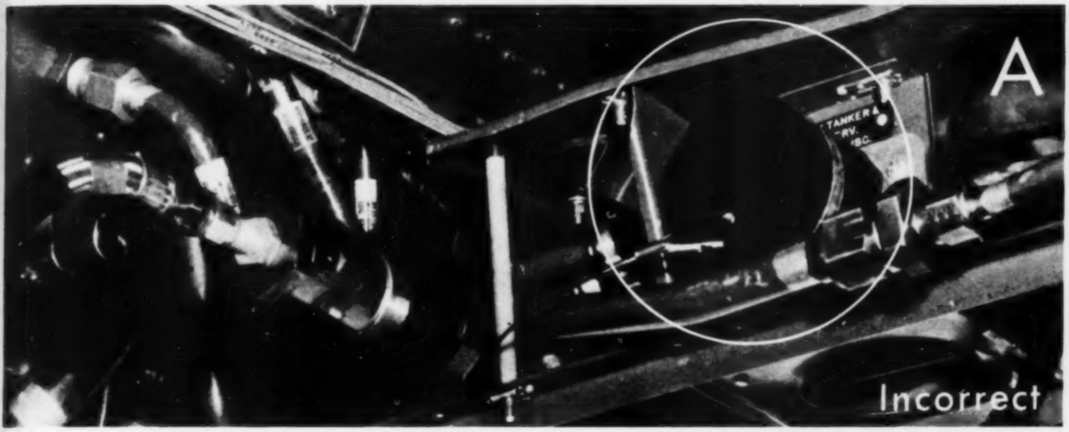
MURPHY'S LAW

If an aircraft part can be installed incorrectly, someone will install it that way!



Radar hydraulic line misinstalled in dust cap stowage bracket (circle).

RA-5C Murphy

MISCONNECTION of the radar flex return line to the adjoining dust cap stowage point, photo A, caused the loss of the No. 2 hydraulic system fluid.

This maintenance error coupled with the failure of the No. 1 hydraulic system resulted in the loss of a 5 million dollar aircraft. Pilot and crewman ejected safely.

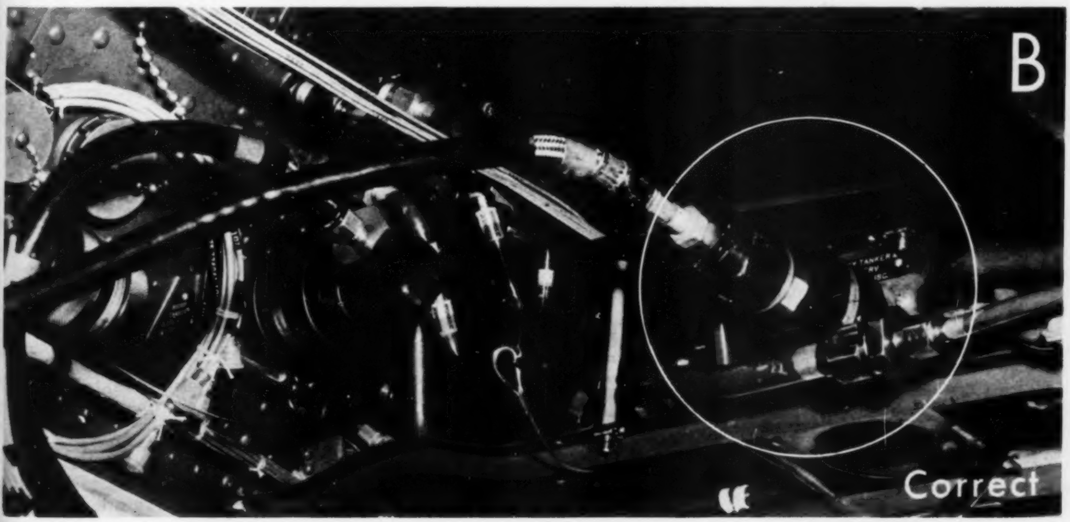
Misconnection, as in this case, can cause one of two failures when the radar system is activated.

1. If the pressure relief plug is installed in the return line, leakage can occur through the relief plug.

2. If the relief plug is not installed, pressure back-up in the return system can rupture the diaphragm in the servo valve manifold assembly, causing loss of hydraulic fluid.

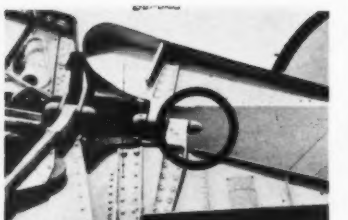
Photo B depicts the proper point of connection of the radar hydraulic system return line located in the bomb bay.

Radar hydraulic line and dust cap properly installed.

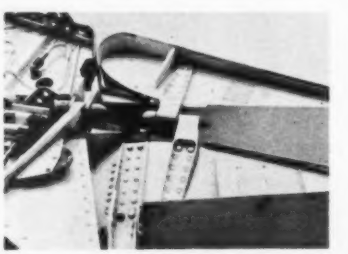


Letters

Want your safety suggestion read by nearly a quarter of a million people in naval aviation? Send your constructive suggestions to APPROACH.



Dust cap (circle) installed.



Dust cap removed for easy inspection.

Flap Trap Inspection

FPO San Francisco—"108 Maintenance Goofs" in the July issue listed an S-2/C-1 with an incorrect installation of the hinge point bolt nut, AN 310-5, causing a split flap condition. Several months ago an aircraft was lost at sea along with two lives, the cause of which may have been the loss of the flap bolt and nut.

In order to prevent such an occurrence we remove the dust cover (see photo) to permit easy inspection by maintenance, pilot and crew to determine (1) if the bolt is installed correctly (head forward and nut aft), (2) nut in place, (3) Cotter pin in place and correctly secured.

PAUL W. PARCELLS, LT
AIRASRON 38

• **Reports indicate others are doing this too. Looks okay provided the fittings are protected from corrosion by sufficient grease.**

Location Identifiers

NAAS Ream Field—The September 1964 APPROACH article entitled "IFR Arrival With Lost Comm" contains a list of location identifiers that omits the most famous NAAS of all: "The Helicopter Capitol of the World," NAAS Ream Field, with the identifier, NRS.

In addition, identifier NCV (Brown Field) was decommissioned 1 August 1963.

W. H. MCINTIRE
ASO HS-8

• **Our goof on the omission. Thanks for filling us in.**

Corrosion Detection by X-ray

NATC Jacksonville—The article in Oct 1964 APPROACH, "Detection of Corrosion Damage" is certainly true but could lead to confusion by persons not technically trained in corrosion detection. While the particular type of corrosion detailed cannot be detected in its early stages by X-ray, other types can be detected very easily by trained operators using standard procedures.

Surface corrosion, either chemical or electrochemical, causing etching or pitting can be detected when as little as 2 percent of the total metal thickness has been corroded away or converted to a metal salt. Also dissimilar metal corrosion caused by electrolytic action can be detected when the same conditions prevail.

Intergranular corrosion can be detected when the condition exists at an angle of 90 degrees to the surface. Exfoliated corrosion can be detected when the condition advances to the point where bulging occurs to the extent where the density change becomes visible in a radiograph. This is certainly not adequate for highly stressed skin areas, but has proven valuable in detecting this condition in inaccessible areas without requiring disassembly.

J. S. BOUCHARD, LT,
TRAINING OFFICE
AIRCRAFT MAINTENANCE
RADIOGRAPHY SCHOOL

• **Your observations are essentially correct. However, the usual x-ray methods cannot be used for detection of corrosion in aluminum if the corrosion products are intact, which generally cannot be established by other methods unless the area is open for visual inspection.**

X-ray methods should not be completely relied upon for early detection of corrosion when cracks have not yet developed. It should be noted, however, that cracks result from corrosion damage at relatively early stages. In other words,

APPROACH welcomes letters from its readers. All letters should be signed though names will be withheld on request. Address: APPROACH Editor, U. S. Naval Aviation Safety Center, NAS Norfolk, Va. Views expressed are those of the writers and do not imply endorsement by the U. S. Naval Aviation Safety Center.

USN Wx Criteria

FPO San Francisco—Your readers may be interested in the enclosed wallet card which we sent out with our newsletter to proficiency pilots assigned to MCAF Futema for support.

ASO

• A handy dandy gidjit, no less, for proficiency pilots. Many thanks.

U. S. Navy Weather Criteria for IFR Clearances

Op. Nav. 3720.2B

	DESTINATION		DESTINATION ALTERNATE	
	VOR, TACAN, ADF, ASR, LF RANGE	ILS PAR	VOR, TACAN, ADF, ASR, LF RANGE	ILS PAR
Multi-Piloted Aircraft	Published minimums	Published minimums	Three hundred feet ceiling and one mile visibility, both above published minimums	Two hundred feet ceiling and one-half miles visibility, both above published minimums
Single-Piloted Aircraft	Two hundred feet ceiling above published minimums and visibility not less than one mile	Published minimums but not less than 200 feet ceiling and ½ mile visibility	Five hundred feet ceiling and one mile visibility, both above published minimums	Two hundred feet ceiling and one-half mile visibility, above published minimums, or 400 ft. ceiling and one mile visibility, whichever is greater

ultrasonic procedures can detect the incipient stages of corrosion in aluminum alloys earlier than x-ray.

The x-ray method is of major importance in the detection of stress-corrosion cracks which generally are more damaging to aircraft parts than pitting or exfoliation corrosion.

The intent of the article was to cover deterioration found in heavy thicknesses of aluminum skin such as used on the A-3 and not the general subject of corrosion of aluminum alloys. A complete treatment of the subject is covered in NavWeps 01-1A-59, "Corrosion Control for Aircraft."

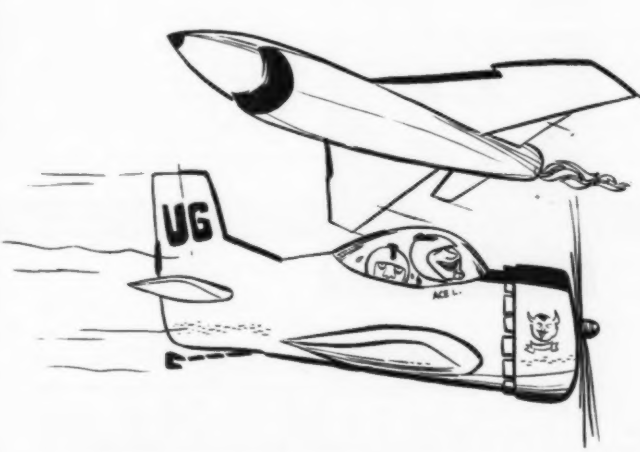
GTC Exhaust Duct Cover

Lemoore, Calif.—Upon starting a tractor-mounted GTC-85 a plastic flashlight which had fallen into its exhaust duct was expelled to a height of 15 feet. Although no one was hurt, nor was there any damage to the GTC or an aircraft, the semi-molten flashlight was a strike.

This is the first incident of its type to occur in this squadron and we hope it is the last in view of the obvious hazard to both man and machine.

It is recommended that grill type covers be installed on GTC units with vertical exhausts.

J. G. WINTHORPE
AMHC, VA-113



"Then in the last part of my lecture I really laid it on the line (that was close) I said there could be no excuse for a careless attitude or sloppy technique."

Re Flash Fires

MCAS Cherry Point—An "Anymouse" entitled "Flash Fires" in the October 1964 APPROACH discusses the hazards of smoking versus O_2 in aircraft. This is at least the second incident of this type that I've read about recently (previous one had USAF aircraft involved.)

The wording of this "Mouse's" last paragraph reads "I spread the word and I think *some* of my colleagues took it to heart . . ." (underlining supplied).

Those personnel who did not fall into the "some" category above should be made aware of what OpNav P3710.7B has to say on the subject.

"Wording. The concept of word usage and intended meaning which has been adhered to in preparing this Manual is a follows: (1) 'Shall' has been used only when application of a procedure is mandatory.
Para. 730 Smoking in Aircraft
a. Specific restrictions—Smoking in Naval Aircraft is forbidden under the following conditions:
(10) Whenever oxygen equipment is in use.
Para. 824 Use of Oxygen
b. Combat and Combat Training Jet Aircraft
(1) Oxygen shall be used by all crewmembers from takeoff to landing. Emergency bailout bottles, where provided, shall be connected prior to takeoff."

Incidentally, as one who roundly cussed the conglomerate collection of directives that were in effect prior to OPNAV P3710.7B, I feel it only fair to give a well done to the "head shed" for this particular directive. Let's cancel and include even more.

OWEN C. BAKER
VMT-1

• You are right.

47

approach Vol 10 No 7

Our product is safety, our process is education and our profit is measured in the preservation of lives and equipment and increased mission readiness.

Contents

DEPARTMENTS

NavWeps 00-75-510

CREDITS

Cover—CHET ENGLE, courtesy Lockheed-California Division Lockheed Aircraft Corp.

Page 23—B. C. by JOHNNY HART, courtesy Publishers Newspaper Syndicate.

Page 31—Chart courtesy USAF Flight Surgeon's Manual.

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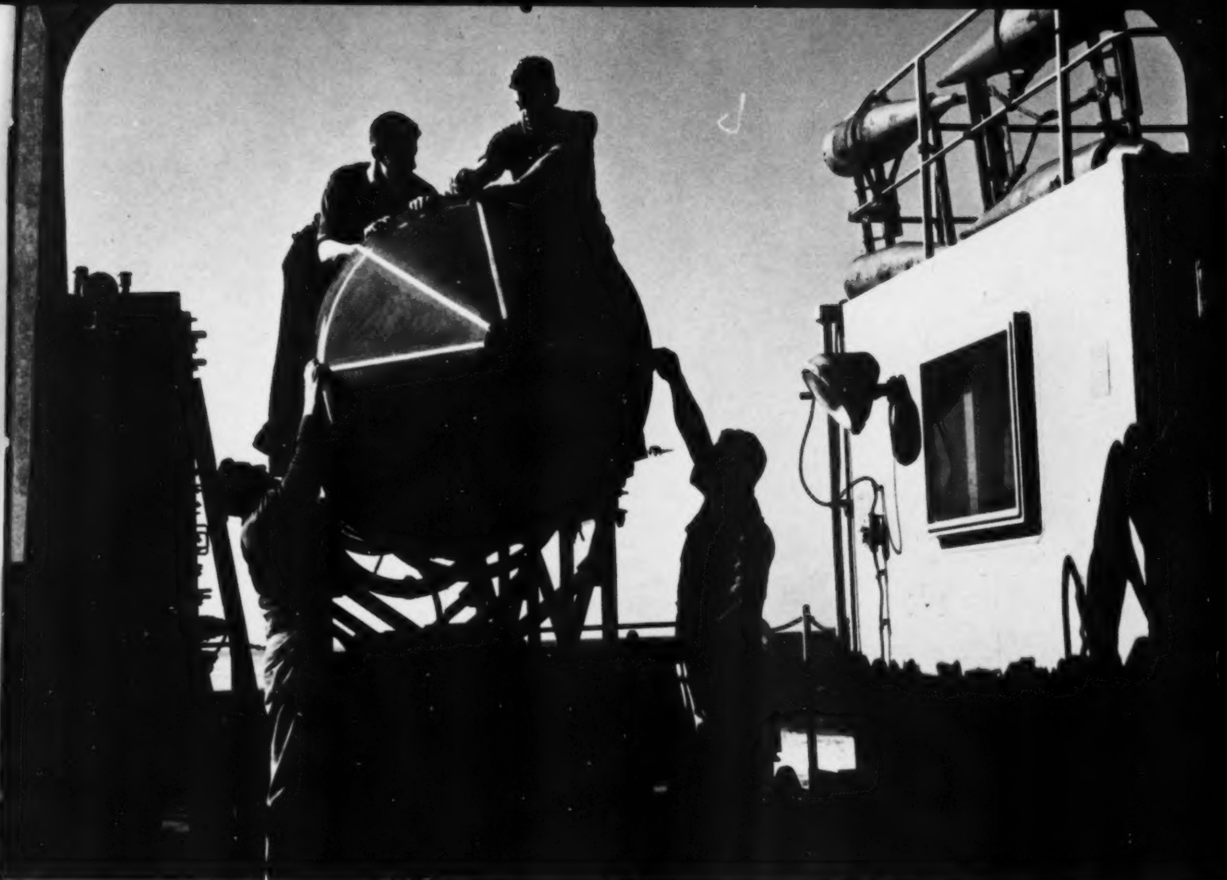
NAVAL AVIATION SAFETY CENTER



Now is the time...

A safety program is directly dependent on the attitudes of squadron maintenance personnel and the quality of maintenance they perform.

If every technician, supervisor and inspector were to do his job in accordance with good maintenance practices and existing directives there would be little chance for a maintenance-error caused accident.

When our present birds were first delivered, the accident rate seemed to zoom. This seems only natural with little experience with a new model aircraft. Since then, with accent on quality control and inspection techniques, the accident rate has taken a decided dip. While Maintenance has little or no control over material failure and pilot error caused accidents it does have a major bearing on maintenance-error caused accidents.

No man in maintenance should rest until the accident rate involving maintenance has fallen to zero and then should expend every control he has to keep the rate zeroed.

This is not the time to reduce our efforts, but is the right time to emphasize quality maintenance and inspection procedures. *Excerpts from VA-122 "Spad Scoop."*

(See "Maintenance Goofs Down, Cost UP!", page 36—Ed.)

LIFT and DRAG


PLIERS
DOWN
FLIERS.
YOURS?